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INTRA-ACCOUNT CLEARING AND THE SUPPLY OF MONEY

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CONTEMPORARY monetary theorists place undue emphasis on demand deposit balances as the most important means of payment in this country.[2] Actually, like coins and paper notes, these balances are being relegated to a subsidiary role in our money supply. The basis of our modern means of payment lies in the check-clearing operations rather than in the deposit-creation activities of the banking system. The neglect of this fact is largely accounted for by the prevalance of the concept of exchange velocity of demand deposit balances, which represents checks merely as a means of transferring deposit balances,[3] and by the failure to appreciate the significance of the

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[2] The term "deposit" is likely to be a source of confusion in monetary analysis. For example, the deposit of a check refers merely to the recording of a credit entry in a bank account, while a deposit balance refers to the difference between the total debit and credit entries recorded in a bank account. As appears below, the deposit of a check may or may not result in a deposit balance, depending on whether or not the credit entry is simultaneously offset by a debit entry to the account. When monetary writers refer to the volume of deposits they mean the volume of deposit balances. The latter terminology will be used throughout this article.

[3] Any careful student of the quantity theory of money realizes that the concept $M'V'$ employed in that theory reduces to the volume of checks, since M' is also

process of intra-account clearing—the simultaneous offsetting of debit and credit entries within an individual bank account.[4] Just as interbank clearing largely eliminates the transfer of interbank balances in the settlement of debts among banks, so intra-account clearing (in so far as it occurs) eliminates the transfer of demand deposit balances among bank customers. As a result of this process, checks are made independent of deposit balances. Although the volume of checks is commonly considered a function of the volume of deposit balances, it is probably more accurate to consider the volume of deposit balances a function of the clearing of checks.

Banking laws and practice in this country have obscured the distinction that exists between a bank account and a deposit balance. The former is a record of debit and credit entries through which a bank performs clearing service for a customer, while the latter is the excess of credit over debit entries in a bank account. As the case of England illustrates, the use of a bank account as well might result in the maintenance of overdraft or debit balances as in the maintenance of deposit or credit balances. With our nation-wide bank-bookkeeping system, however, the checks which offset within individual bank accounts, and not the checks which represent transfers of deposit balances, are our main means of payment.

For example, an active business firm continually pays out large amounts in checks to meet its expenses of production, and receives large amounts in checks from current or past sales. At the end of each day a certain volume of debit and credit entries are posted in its bank account. As these entries are posted, they offset to a large extent and leave a relatively small net credit (deposit)

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used as the deonominator of the ratio V'. In view of this fact, the emphasis on demand deposit balances can be justified only on the assumption that the volume of checks depends on the volume of deposit balances. As appears below, this assumption must be qualified to the extent that intra-account clearing occurs.

[4] In intra-account clearing the credit and debit entries to a particular account may represent checks received from and paid to the customers of banks other than that in which the account is maintained. It is not necessary for the occurrence of intra-account clearing that the holder of an account make check payments to the same parties from whom he receives checks.

balance. If a credit balance already exists within the account it will change only to the extent that daily debits and credits do not offset each other. A deposit balance, then, is a result of the uneven flow of checks into and out of an account, rather than a "given" quantity of money which circulates through the community by means of checks.[5]

Only to the extent that debit and credit entries to an account fail to offset completely at the time of posting does a shift in deposit balances occur. Thus, if $6,000 is debited and $5,000 is credited to the business firm's account at the end of the day, a shift of deposit balances equal to $1,000 occurs among bank accounts. The business concern has made $1,000 in check payments by drawing on an existing deposit balance in its account; but it has made $5,000 in check payments through its bank account independently of any deposit balance because, at the time of posting, checks to be debited to its account were matched to that amount by checks to be credited to its account. Since checks deposited for credit to a bank account do not appear as a deposit balance if they are offset at the time of posting by checks that have been drawn on that account, it is wrong to regard all checks as drawn on deposit balances. A firm's check payments depend far more on its current income than on any deposit balance in its bank account. A deposit balance is the source of check payments only to the extent that the firm is currently making payments in excess of receipts.

The relation of the time factor to the process of intra-account clearing requires special emphasis. Clearing is defined as a simultaneous offsetting of claims of indebtedness.[6] If a person deposits

[5] In the case where a businessman obtains a deposit balance directly through a bank loan, the businessman borrows to overcome a lag in receipts. Here, too, the deposit balance is created because of an uneven flow of checks.

[6] Some writers contend that the clearing process in itself does not settle debts. They refer to interbank clearing and overlook the process of intra-account clearing. They point out that a bank receiving a check through the clearing house will return it if the account on which the check is drawn does not contain a credit balance; and that, therefore, the clearing process in itself does not settle debts. But even when the account contains no credit balance, the bank will not return the check if a check of equal amount is deposited to the account by the time of bank posting. It is because not all checks currently clear that banks require their customers to main-

a check to his bank account in the morning and draws a check which is presented to the bank against his account in the afternoon, it is considered at best a case of deferred clearing. In such a case it is argued that a deposit balance is the actual means of payment. The fact is overlooked that neither check appears as an entry to the individual's account until the time of bank posting, at which time the debit entry and the credit entry may completely offset each other. While clearing is a simultaneous offsetting of debits and credits, it occurs only periodically within the banking system. In the larger city banks, checks are posted to customers' accounts by blocks several times during the day, while in many small banks postings are made only at the end of each day.[7] In the intervals between postings, checks representing future debit and credit entries to a particular account may accumulate in large amounts. At the time of posting, these debit and credit items will offset probably to a large extent. Thus it is not necessary for the occurrence of intra-account clearing that a person receiving a check immediately draw a check of equal amount. To the extent that checks to be credited to an account are matched between the times of posting by checks to be debited to that account, intra-account clearing will occur.[8]

The volume of checks may increase independently of any initial credit balance in an account, in so far as intra-account clearing occurs. As far as the deposit balance is concerned, it makes no difference whether $5,000 or $50,000 in checks is debited and credited to an account each day, since in either case the

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tain deposit balances. Thus the contention that clearing does not settle debts is based on an incomplete analysis of the clearing process.

[7] Although large banks make several postings during the day, overdraft notices are not made up until the end of each day. Thus, even though a check overdraws a deposit balance at the first posting of the day, the bank may accept the check on the assurance of the drawer that a check to be credited to his account will appear, say, in the afternoon posting.

[8] Frequent bank postings maintain standards of business practice among banks and among bank customers that help to establish the check as an important means of payment. The amount of offsetting that occurs at the time of posting within the account of a borrowing customer is an indication of the liquidity of that customer. For the same point in connection with interbank clearing see H. P. Willis, *The Theory and Practice of Central Banking* (New York, 1936), p. 343.

checks offset each other. Theoretically an infinite volume of checks might be drawn and cleared without any deposit balances whatsoever. To the extent that the expenditures of individuals and business firms are increasing simultaneously, debts may be settled through the offsetting of debits and credits within each bank account. In case the reader feels that an increase in expenditures must be based on deposit balances, let him consider the situation in a period when business confidence is being restored and higher prices are being offered for increased amounts of goods and services. As larger orders are passed among retailers, wholesalers, and manufacturers, there will be an extension of commercial credit and a corresponding expansion of commercial indebtedness. On settlement dates at the end, say, of thirty-day periods, many firms will draw checks in the knowledge that such checks when presented against their accounts will be matched by check receipts. Thus the volume of check payments that can be made is very largely a function of current check receipts. Only when current check receipts are not sufficient to meet current check payments will check payments be made out of deposit balances. Intra-account clearing, then, permits an expansion of the volume of checks without the necessity of increases in the volume of deposit balances. Nor does an expansion of the volume of checks cleared mean an increase in the turnover of deposit balances.

Of course, checks drawn and checks deposited by any individual or business firm only partially offset between the times of bank postings. Business practice has established customary settlement dates (such as the end of the week or month) when business concerns pay a large part of their expenses of production. The receivers of this income deposit some of their checks and settle some of their debts on the same date. If checks which they draw (or have drawn) are presented against their accounts on that date, intra-account clearing will occur. To this extent checks effect the settlement of debts independently of deposit balances. Income receivers settle some of their debts, however, on dates different from those on which they receive their incomes, so that checks to be charged to their accounts may not offset

checks to be credited to their accounts between the times of bank postings. As a result of this time-lag, some deposit balances are continually shifting from one account to another through the medium of checks. In so far as this is true, deposit balances may be considered as means of payment, and checks as instruments for their transfer. Furthermore, a businessman may have to secure a deposit balance through a bank loan when he wishes to make current payments in excess of current receipts. By establishing a credit balance for him the bank increases his current receipts sufficiently to offset his current payments. In these ways deposit balances supplement the check-clearing mechanism as a current means of payment; but this is not their main function in our country today.

The bulk of demand deposit balances represent reserve funds for meeting contingencies. They furnish a margin of safety for their holders, who regard them for the most part as means of overcoming gaps that may occur between future receipts and payments. By using these balances when such gaps occur, depositors may be released from the necessity and, often, the risk of converting nonmonetary assets into monetary form. If forced at times to draw heavily on his deposit balance, a depositor ordinarily will try to restore it at a later date to what he considers a "safe" amount. Thus, demand deposit balances serve largely as safety and convenience funds rather than as current means of payment.

In practice, the dividing line between the use of deposit balances and the process of intra-account clearing as methods of making payments is not clearly drawn.[9] A business firm does not regulate its check payments so that each check presented against its account will be offset at the time of posting by a check of equal amount to be credited to its account; but it does adjust the volume of its current check payments with a view to the volume of its current check receipts. As a result, the volume of debits and

[9] Monetary writers have concerned themselves with the distinction between demand and time deposit balances as current means of payment. They consider demand deposit balances as the main means of payment; but they recognize that time deposit balances may, in part, perform the same function. They entirely overlook the process of intra-account clearing and the consequent importance of checks as a distinct means of payment.

credits recorded within its account will tend to clear at each posting so that the size of the deposit balance within the firm's bank account will vary but slightly in relation to the volume of payments that are made through that account.

Bank accounts may contain average deposit balances equal to the check payments of many days or even weeks; but in no sense does this fact imply a dependence of the total volume of checks on the volume of average depsoit balances, since checks may be made independent of these balances through the intra-account clearing process. Moreover, if the bulk of deposit balances are held as liquidity funds, it is not likely that they will be transferred in large amounts from one account to another except under abnormal conditions. Consequently, such transfers will not contribute greatly to the volume of checks drawn over a period of time. Obviously the ratio of checks drawn on and cleared within an individual account to the total volume of checks drawn on that account will vary among different classes in the population. The ratio presumably would be highest in the accounts of business and financial firms whose payments and receipts synchronize much more closely than those of individuals; and it is through such accounts that most money payments are made.

The conclusion of the preceding analysis is that, in so far as intra-account clearing occurs, checks must be regarded as a distinct form of money. In the absence of data on the percentage of checks cleared within individual bank accounts, the extent to which this conclusion applies to the operation of our money system cannot be definitely known. On the assumption, however, that there is a large volume of intra-account clearing, certain theoretical and practical implications follow from our analysis.

The widespread use of bank checks in this country facilitates the clearing process by centralizing it within the banking system. Intra-account clearing, in turn, releases a large volume of checks from any dependence on deposit balances. Those writers who stress the means-of-payment function of deposit balances and postulate a causal relationship between changes in the volume of these balances and changes in price levels overlook the fact that a large proportion of the total volume of checks, through which the actual transfer of goods and services is effected, has

no connection with deposit balances. Only to the extent that check payments represent transfers of deposit balances would it be possible to conceive of deposit balances in their means-of-payment role as a determinant of price levels.

The concept of exchange velocity of deposit balances has unfortunately obscured the distinction between checks and deposit balances as different forms of money. The application of such a concept to our money system may be theoretically challenged both on quantitative and on qualitative grounds. The concept implies that check payments represent transfers of deposit balances. If this were true, it would be theoretically impossible for the volume of checks to exceed the average volume of deposit balances times the number of bank postings over a period of time, since the possible transfers of a given volume of deposit balances is limited by the number of bank postings in a given period. Assume a community in which the entire money supply consists of $1,000,000 in demand deposit balances, and in which banks post checks to their customers' accounts only at the end of each day. If check payments really represent transfers of deposit balances, the maximum possible volume of check payments that can be made over a period of twenty-six days is $26,000,000, and the maximum monthly velocity of deposit balances is 26. Actual velocity might be any figure less than 26, depending on the spending psychology of the community during the period in question. The point is that the exchange velocity concept implies a definite upper limit to the velocity figure and that this limit would presumably be affected either by changes in the average volume of deposit balances or by changes in the number of bank postings over a given period of time. This conclusion should lend some encouragement to those writers who despair of monetary control mainly on the grounds that exchange velocity cannot be regulated.

Intra-account clearing, however, removes the theoretical limit to the volume of check payments that can be made in a given period of time, since check payments are constantly matched by check receipts. If checks are drawn with more regard to current check receipts than to present deposit balances, and if many

checks offset within individual bank accounts at the time of posting, techniques devised to regulate the volume of deposit balances will have relatively little effect on the total volume of means of payment. If control of the money supply is really desired, a percentage charge on the value of each check drawn would be much more effective than a change in rediscount rates or in legal reserve balances. Such a charge would affect both the volume of checks which represent transfers of deposit balances and the volume of checks which, through the intra-account clearing process, are made independent of deposit balances.[10]

The process of intra-account clearing injects a qualitative inconsistency into the concept of exchange velocity. The velocity ratio is computed on the assumption that the entire volume of checks drawn represents transfers of deposit balances, whereas a substantial percentage of the checks drawn has no connection with deposit balances. If the amount of checks which do not clear within individual bank accounts were known, the ratio of this amount to average deposit balances over a certain period of time would give some indication of the effectiveness of these balances as a means of payment. To use total checks drawn as the numerator of the velocity ratio, however, gives a very wrong impression of the activity of deposit balances. These balances, for the most part, are held for liquidity and not for current payment purposes. If a large part of the checks which are used in making current payments is independent of deposit balances, the combination of checks and deposit balances in a ratio has little meaning. Such a ratio has about as little significance as a ratio of currency in circulation to average deposit balances. In both cases the component parts of the ratios perform largely different monetary functions and react in very different degrees to large changes in economic activity.[11]

Although there is no available data on deposit balances strictly comparable with data on debits, a rough indication of the disproportionate changes that occur in the volume of checks and the

[10] The flat service charge now made by banks on the use of checks really represents payment for the provision of a check-clearing method of settling debts.

[11] J. W. Angell, *The Behavior of Money* (New York, 1936), p. 59.

volume of deposit balances is given by the facts that debits to all individual accounts in 141 centers increased on an annual basis over $536 billion from 1921 through 1929, while deposit balances (other than interbank deposit balances) of all banks in the United States increased about $18 billion from June 30, 1921, to June 29, 1929.[12] The increase in the volume of debits was over twenty-nine times as great as the increase in the volume of deposit balances. Corresponding data show that debits decreased over $612 billion from 1929 through 1932 while deposit balances fell about $12 billion from June 29, 1929, to June 30, 1932.[13] The decrease in debits was fifty-one times the decrease in deposit balances. What is the explanation of such great differences between changes in debits and changes in deposit balances? Part of the increase in debits during the twenties represents transfers of an increased volume of deposit balances; probably a larger part represents increased intra-account check clearings. As more checks are drawn, the volume of debit and credit entries to bank accounts increases; and the probability that debit and credit entries will offset each other in larger amounts increases. Thus the growth in the volume of checks during the business upswing of the twenties was most probably accompanied by the settlement of a greatly increased volume of debts through intra-account clearing. If this analysis is valid, the concept of monetary inflation must include much more than the deposit-creating activities of the banking system.

Many writers have grasped the concept of our banking system as a huge clearing mechanism, but their analyses include only interbank clearing. Much more important is the process of intra-account clearing and its implications for monetary theory. The whole subject of interest rates might be profitably re-worked in view of this process. The object of this paper will be achieved if this hitherto neglected aspect of our money system receives the careful attention it deserves.

[12] *Sixteenth Annual Report of the Federal Reserve Board*, 1929, pp. 102 and 122. To consider the deposit balance figure for one day in the year as an approximation of average daily deposit balances for the year probably does not involve serious error, since deposit balances have little seasonal movement. Cf. Angell, *op. cit.* (1936), p. 39.

[13] *Nineteenth Annual Report of the Federal Reserve Board*, 1932, p. 121.

INDUSTRY ORGANIZATION AND THE ROLE OF GOVERNMENT

J. D. A. MORROW[1]

IT IS my belief that the individual business units in every industry should be permitted to act together voluntarily, if they desire, for the purpose of organizing and controlling the industry of which they are a part, in general as follows:

1. Individual concerns should be permitted to enter into voluntary associations, sales agencies, or other groupings in whatever manner they might elect, for the purpose of collecting and compiling current information pertinent to the industry or line of business in question; of conducting research and experimentation; of simplifying, improving, and standardizing products; of agreeing on prices, terms, and conditions of sales; of agreeing upon division of territory or markets; and for the purpose of acting in unison on all other matters of common interest and mutual benefit.

2. Voluntary agreements for the same purposes should be permitted among and between such groups and all such agreements—those between groups, between the members of any group, or between the members of a group and the group—should be legally enforcible in the courts.

3. No compulsion should be exercised on any individual to force him to join any such organization. He should be entirely free to stay out or come in as his own interest would determine.

4. Whatever business statistics and information are collected and used by such groups should be published currently so that competitors and consumers would have the advantage equally of such information.

[1] Mr. Morrow is president of the Pittsburgh Coal Co., Pittsburgh, Pennsylvania. The author's statement was made in answer to the following questions put by the editor: (1) To what degree, if at all, should the independent business units in an industry be permitted to act together for the purpose of organizing and controlling the industry of which they are a part? (2) What part, if any, should government have in (*a*) helping to organize business on an industry basis, (*b*) controlling the kind of organization which is set up?

From my experience it is evident to me that many advantages would accrue from such voluntary concert of action among members of many, possibly of all, industries, though the extent and character of such benefit would vary with conditions in different lines of business or industry. The collection and publication of current information would afford a basis for more intelligent action and for sounder business judgment with respect to the development and expansion of any business or industry, and would be of material assistance in many cases of preventing individuals and concerns from embarking on business ventures which are certain to be unprofitable. Such losing ventures represent a definite social loss, and so far as voluntary action of industry can operate to avoid them, in my opinion such action is advisable.

United action, somewhat similar to what is here indicated, has already resulted in many industries in great improvement of product and in the advancement of research and development. It can also result in lower costs, which should inure to the benefit of consumers as well as to the building-up and maintenance of sounder and more stable industrial and business structures.

The enforcement of individualistic competitive methods often can and does represent, in my view, a definite economic and social loss to the community. For example, in the bituminous coal industry I am familiar with an important producing field, in which a dozen outstanding companies are mining and selling coal. Under the anti-trust acts they are forced to compete with one another—I am disregarding the temporary effect of the National Bituminous Coal Act, for it expires by limitation in four years. Each of these companies must maintain enough mines and mine capacity, with machinery, equipment, employees, and working capital, to supply the peak demands of their customers. A careful study of the operations of these companies, made a short time ago, indicates that if they were permitted to combine their sales of coal, which is all of one general type, they could conduct both their production and their sale of coal on a unified basis. This would permit them to shut down several unnecessary mines, and they could reduce their operating, selling, and management costs approximately twenty-five cents per ton. They would be able to give

steadier employment to a somewhat smaller number of men, and through lower prices, which they then would be enabled to quote, could more successfully combat the competition of fuel oil and natural gas, could thus expand their business, and could convert the business of these companies from chronic operation at a loss into the reasonably certain expectation of profits from year to year—almost unheard of now in the coal business.

As to your second question, I have already said that I would have the formation of these agreements and any concert of action by individuals or by groups purely voluntary. I would explicitly expect both federal and state governments to refrain from exercising any authority or compulsion or influence, either to promote and foster or to hamper and prevent the formation of such organizations. I would give them a free hand to develop or not to develop, as the varying and changing interests, demands, and exigencies of every industry might or might not make them advantageous and desirable.

However, government should act as a completely informed and impartial umpire. The Federal Trade Commission, or some other appropriate agency that might be set up for this purpose, could perform this function. As a condition of permitting such voluntary organizations of business and industry, whatever information or statistics they collected and used should be made public at the same time for the use of government and consumers as for the use of members of such group or industry. Further, the commission should have the authority to make whatever investigations into the activities and records of such groups as would be deemed necessary for its complete information and should have authority to require them to furnish currently such regular reports as it found necessary for the discharge of its duties.

All agreements, contracts, and understandings with respect to standardization or simplification of product, methods of cost accounting, the establishment and maintenance of prices, the division of territory or consuming markets, and all similar understandings and agreements should be filed with such commission for thirty days prior to the effective date thereof. The commission should have authority to disapprove any such agreements if

found to be against the public interest; but if not disapproved within the thirty-day limit, then all such agreements should be binding upon the parties thereto and legally enforcible in the courts. Subsequent to such agreements going into effect, all changes therein should be filed currently with the commission.

The commission should have authority at any time, either upon complaint or upon its own motion, to investigate fully the methods, practices, and activities of such groups. After such complaint, hearing, or investigation, if the commission found the methods, practices, or provisions of any agreement to constitute unfair competition against any competitor, or found prices, terms of sale, or other conditions of conducting the business extortionate or oppressive of the public, then the commission should have authority to issue forthwith a cease-and-desist order. In the event the commission, within the thirty-day period of examination of agreements filed with it, disapproves of such agreements or subject to approval and after investigation issued a cease-and-desist order, then the members of such group or groups, if they continued to carry out such agreements or maintain such prices or business practices, would be subject to the penalties of the anti-trust statutes, and the commission should recommend to the attorney-general of the United States their prosecution thereunder.

This short answer to your inquiry does not attempt to cover many details that may occur to you. In general, it contemplates giving industry and business the freest possible hand in developing concert of action in any direction to any extent desired, but with government watching over that development to see that individual initiative is not smothered, that everybody plays the game according to rules that insure fair play, both among the players and as between them and their customers. After that, let the best man win. This general statement will indicate the treatment of details not covered here.

At first thought it may seem that this program presents a picture of industry and business crystallizing into rigid forms without competition. This gives me no cause for worry. As long as the individual is free to act without compulsion, either from a group

of competitors or from government, but is left free to associate himself with others or not as he elects, some of the most efficient in most lines of business will usually elect to stay out of any combination, association, or group. They will always reason that they must sacrifice part of their competitive advantage to protect weaker and less fortunate individuals in their business or industry if they join some group or combination. Smaller and weaker units in each industry would usually benefit by concerted action, and self-interest would lead them to follow this course. Competition would be better informed—perhaps keener but less destructive than now.

Furthermore, there is a greater degree of competition between products of different lines of industry than is generally understood. For instance, even if the several thousand bituminous-coal producers were miraculously organized into a few producing and selling combinations, they could not go far in raising the price of coal anywhere in the United States without immediately opening the way for greatly increased sales of oil, natural gas, and other competitive fuels. If copper gets too high in price, aluminum can take its place in surprising fashion. Cotton, silk, wool, and rayon compete against one another, and whenever the attempt is made too widely to combine industries, interests, and products that are diverse, the cumulative weight of individual, peculiar, different, and even antagonistic interests is so great that effective combination becomes impossible. And, finally, there are and always will be plenty of businessmen like Henry Ford who are determined to stay free, to run their own business enterprises in their own way, and will not join any group.

In conclusion, therefore, this suggestion of mine would permit concert of action under fair competitive conditions where it is advantageous in the general economic and social fabric. If it is allowed so to develop naturally under the limitations indicated, it will grow only where it has a definite, useful place and function, and in such place and from such functioning society would inevitably benefit.

WHAT SHALL WE DO ABOUT DEPRESSIONS?

GEORGE E. PUTNAM[1]

I

FOR a whole generation we have been trying to find some way of preventing depressions. It has seemed inconceivable that an intelligent society which has succeeded through conscious effort in solving so many of its problems should have to tolerate those recurring periods when trade is at a standstill, when factories are closed, when millions of men are thrown out of work through no apparent fault of their own, when small investors lose a substantial part of their savings, and when the depression in trade and industry is exceeded only by the depression in man's spirit. While it is realized that the riddle of these recurring cycles is extremely complicated, there is nevertheless a growing conviction that we can do something about it. Finding a dependable preventive of business depression is probably the most important task that confronts society today—because, if we could somehow plan our affairs so that business would follow a more stable course, we should solve at one stroke a whole host of other pressing problems.

After every severe recession in business since the turn of the century we have exclaimed: "It must not happen again"; and we have forthwith taken steps that we hoped would be preventive. We made our first move in this direction after the panic of 1907 and the business depression of 1907–8. A study of the situation at that time brought us to the conclusion that our banking system was obsolete, and that the defects of the system were primarily responsible for the panic. Next we reasoned that if we renovated our banking structure so that financial panics could be avoided, we would go a long way toward preventing the business depressions that seemed to follow. In this respect our conclusion

[1] Professor of economics at the University of Kansas, 1911–16; professor of economics, Washington University, St. Louis, 1917–20; since that time an industrial economist with headquarters in Chicago.

was not unlike that of the histrionic cock—declaring that he could order the time of the rising of the sun because he had learned from long experience that the sun invariably rose after he crowed.

However faulty our prewar reasoning on the depression question may have been, it at least gave us a vastly improved banking structure in the shape of the Federal Reserve System. Under this more centralized form of banking we succeeded in getting along without a bank panic for nearly two decades. But when it came to side-stepping the ills of depression periods we were not so fortunate. During the first twenty years that the Federal Reserve Act was on the statute-books we had two depressions of the major variety. The first of these came in 1920 following the inflation and expansion of the war years, and it brought disillusionment to those who had thought that the proper preventive lay in having a well-ordered banking structure.

After the first shock of disillusionment had passed, we calmly accepted the depression of 1920–22 as a part of the inevitable aftermath of war. But those charged with the administration of the Federal Reserve System were not so complacent. Feeling no doubt that credit policy had been partly responsible for the collapse of prices in 1920, and confronted with the problem of handling unprecedented importations of gold, they broke away from the central-bank tradition of looking to the reserve ratio as a guide to credit policy and started off afresh. Without any blaring of trumpets they initiated a policy of dispensing credit to business according to their conception of business needs. And for a time they did a creditable job. The success that seemed to attend their efforts in stabilizing prices and business by means of currency management and hortatory devices aroused new hope that the long-sought-for preventive had been found.

The stock-market collapse in the latter part of 1929 ushered in the second major depression—and the second disillusionment—under the Federal Reserve. There was no bank panic to pave the way as in 1907. Curiously enough, the banking panic did not come until the low point of the depression had been reached in the early part of 1933; then we had a panic of record-breaking proportions. For that matter, the depression itself was probably

the most severe the world had ever experienced. The collapse in business was world-wide, and as the years went by it seemed that recovery would never come. A glance at the volume of unemployment in the world today makes one wonder whether we have yet emerged.

II

Still looking for deliverance, we have busied ourselves since 1932 devising new formulas of action—formulas calculated to hasten recovery or to avert depressions in the future. We have gone farther in quest of preventive measures than ever before. The sum and substance of our official thinking to date was stated by President Roosevelt in his radio address of October 22, 1933, in the following words: "When we have restored the price level we shall seek to establish and maintain a dollar which will not change its purchasing and debt-paying power during the succeeding generation." And in referring to this statement in a letter to Senator Thomas, May 20, 1937, the President added: "I am sure that you will agree with me that stabilization of the value of the dollar will be attained not merely by monetary means and devices, though these are necessary, but much more by the achievement of balanced and orderly recovery throughout the whole economy, and by its maintenance once achieved."

Taken together, these statements by the President clearly indicate that the goal of present policy is to stabilize prices by stabilizing business. The stabilization of business must be included as a part of the program, because in most instances the movement of prices is the result of business activity—or inactivity—and not the primary cause. It goes without saying that there could be no depressions if prices and business were stabilized.

The instruments to be used in attaining this objective would vary according to circumstances. Presumably a great deal of reliance would be placed on the management of bank credit, as in the early twenties. This instrument might be supplemented from time to time by official warnings to business if prices rose too high, or, in the event that prices showed a declining tendency, by dollar devaluation, by priming the business pump through vast public expenditures, and by a number of other devices. One

is justified in inferring, in the light of recent experience, that pump-priming would be resorted to in a large way, if necessary, to stop or to prevent deflationary tendencies.

When one pauses to rationalize about the various aspects of our official objective, one is forced to the conclusion that we are in for more disillusionment. In the first place, we have no assurance that the imminence of depression will be recognized in time to apply our preventives. As recently as August, 1937, when all the trade indices suggested fair weather, no one was able to divine that we were about to have a serious recession in business. During the last five months of that year there was an unexpected and precipitous decline in both business and commodity prices. The prices of raw materials declined more than 25 per cent. In virtually all industries operations were curtailed and the number of employed workers was greatly reduced. In many instances factories were closed. The fall in prices told us what was happening, but we could not bring our magic forces into play until after the damage had been done.

There is a serious question, too, about the adequacy of our instruments of control. We learned to our sorrow in the late twenties that the power to stabilize business and prices through the control of credit is limited. Now we are learning something about the limitations of pump-priming. As a practical matter, pump-priming is not a device for preventing deep recessions. It is at best a costly and inefficient method of stimulating business after business has declined. Moreover, the underlying theory that debts incurred for the construction of vast public works during years of depression will be repaid in prosperous years is hardly tenable. Recent experience suggests that instead of removing the causes of depression pump-priming tends to perpetuate the disorders that create depression—with the result that when government spending stops or slackens its pace the old disorders reappear and new pump-priming must be resorted to. No one has yet ventured to suggest that pump-priming should be a continuous operation or that government finance could stand the strain.

Obviously, we have not approached and are not now approaching the riddle of depression in the spirit which the problem merits.

Instead of seeking out the basic causes of the disease—that is what depression is—and removing them, we are concentrating our attack on the symptoms without giving proper consideration to the question as to where our plan of attack will lead us. In the world in which men make their living there is a price to be paid for every unsound policy, whether it is the policy of businessmen or the policy of the whole people through their government. Unless we develop a reasoned policy based upon a clearer understanding of the nature of the disease we are trying to eradicate, we shall only aggravate our difficulties.

III

No argument is needed to support the conclusion that if we are to be the masters of our own destiny where depressions are concerned we must first of all know what causes them. In this field, as in all others, our knowledge is limited, but by no means valueless. We know, for example, that human nature is one of the fundamental causal factors in business depressions. In the human being, as in business, there are alternate moods of courage and fear, joy and sorrow, laughter and gloom. And how infectious each of these moods becomes when human beings are together! Laughter invariably breeds laughter, while gloom breeds gloom.

The characteristics to be found in the human family at leisure are the same characteristics that may be observed in the toiling crowd. Once confidence has been aroused within a group of businessmen, and no disturbing incident occurs to block its path, it soon trickles through to other groups and business quickens its pace. On the other hand, when the leaders in the business community become fearful as to what the future holds—as they were during the latter part of 1937—fear spreads from group to group, plans that were about to be put into operation are held up, all try to make their position less vulnerable, and business recession is on.

The mood which happens to take possession of businessmen at a given moment may or may not be reasonably justified by the current situation or outlook, but once it has found lodgment it generally takes command. Business "has to be shown" before the

mood can be dispelled, and the course of business is affected accordingly. Because of this inertia of group moods, prosperity becomes too prosperous, depression too depressed, and each of these periods is likely to last longer than the facts in the situation warrant.

Another thing we know about depressions is that they are essentially a product of the industrial age. In the earlier non-industrial societies depression periods were unknown—except as drought or other visitations may have left whole communities destitute. The early white settlers in the United States had no depression problem to contend with. They grew their own food, produced their own clothing, and constructed their own shelter. The American pioneer was his own landlord, capitalist, employer, and employee. He lived on what he produced. In that stage of self-sufficiency there could be no industrial depression—for the simple reason that there were no industries.

How different the situation has become! Nowadays men do not live as hermits, each producing his own food, clothing, and other requirements. On the contrary, most individuals are specialists. Some devote all their time to the production of raw materials for food, clothing, and shelter; others supply necessary transportation facilities and services; still others engage in manufacturing or distributing finished products, including the machines or other equipment used in the productive process.

Within each of these specialized groups there is further specialization. In the raw-material group will be found individuals who contribute only one product, such as wheat, corn, cotton, pig iron, etc. Between these specialists and those who turn out the finished products are other specialists, some in the form of great industries. The business of producing raw materials has been growing more complex with each generation. Not many years ago such articles as flour and cotton goods were finished products. Now they are the raw materials for the baking and garment industries, respectively.

In the industries devoted to the making of finished products there is specialization of an even more complex kind. Here an individual does not spend his time turning out one product, but

rather a minute part of one product. Under present-day methods the co-operative effort of thousands of workers is needed to produce a pair of shoes, a motorcar, a washing machine, or even a loaf of bread. No single factory is equipped to manufacture all the parts that go into a final product. In every industry the manufacturer finds it economical to obtain from the various units in other industries, which also have their own specialized labor and equipment, some of the parts he requires. Because of the interdependence of all sections of modern industry, the number of hands through which a product, or some part of it, must pass on its journey from the primary producer to the final consumer has become legion.

All these wealth-producers, many of whom live thousands of miles apart, must come together at one or more market places in order to exchange their products and services for the products and services of one another. How else could the producer of wheat obtain shoes or the worker in a shoe factory obtain bread? In order to facilitate these exchanges under our scheme of specialized production we have had recourse to the use of money. Instead of having to find someone who has shoes and wants wheat, the farmer sells his wheat for money, and he then uses the money to purchase the manufactured articles he requires. Actually, he produces wheat in order to exchange it for the products of industry. His supply of wheat is a demand for manufactured articles. His purchasing power is simply the quantity of other goods he can obtain in exchange for his wheat supply. And the same may be said as to the purchasing power of every other producer.

The process of exchanging goods for goods is not unlike the engine of a motorcar. It works well enough when the various parts are in order and are properly co-ordinated; but let some of the parts become defective, so that they are unable to co-operate with other parts, then the effectiveness of the whole mechanism is destroyed.

It may be stated as a fundamental principle that depressions are the result of disturbed relations in the complex trade and exchange processes which have necessarily grown up under our system of specialized production. When something happens to dis-

turb the balance, the parts no longer co-ordinate properly. Sometimes the reason for unbalance is fear of government policy. At other times it may be traceable to past policies of the government. Usually it is the result of unsound policy on the part of human beings themselves, causing them to lose all semblance of balanced judgment in their business commitments.

IV

For an illustration of the unbalance that unsound government policy may cause we need only refer to the long depression that began eight years ago. In this instance there developed a frightful unbalance in our internal mechanism of trade and exchange primarily because of the breakdown of international trade and the loss of markets on which we had become dependent.

It will be remembered how fearful we were in 1921 lest our markets be flooded with European goods. We had loaned billions of dollars to the Allies during the war and post-war period, and we had made it clear to all that, irrespective of the settlements the allied countries might make with one another, we would not be a party to any policy of all-around cancelation. At the same time we were being warned continuously by the experts that if we insisted upon the payment of these debts we should have to take goods in payment. Fearing that this prediction might come true, we made haste in 1921 to put through the Emergency Tariff Act. This was followed by the Fordney-McCumber Tariff Act in 1922 and the Hawley-Smoot Tariff Act in 1930. We were determined that we did not want foreign products. Let foreign debtors find some other way of paying us.

No sooner had we denied to these debtors the right to pay us in goods than they began to send gold, a duty-free commodity. The new gold greatly increased our supply of credit and, paradoxical as it may seem, we were so anxious to make use of our redundant credit that we took the promissory notes of foreign debtors in payment for the goods they purchased, and more promissory notes in payment of the interest and sinking-fund requirements on previous debts. But as we continued to take their gold and promissory notes we so contributed to the impairment of

their currencies that they were forced to impose tariffs, quotas, and prohibitions (on the products they ordinarily bought from us) in order to give what protection they could to their currency systems.

The upshot of the matter was that, having adopted a national policy which denied to foreign debtors the right to pay their obligations in the normal way, it became physically impossible for us to get our payments or to go on selling our surplus products abroad. We therefore lost most of the interest and principal due us and we lost our foreign markets besides. The loss of foreign outlets was the more serious blow. Products that would normally have gone abroad piled up in our domestic markets. Under the impact of this "surplus" created by the shortage of foreign outlets our whole specialized system became unbalanced to the breaking-point.

The farmer was probably the worst sufferer because he had become more dependent than any other producing group upon the maintenance of foreign outlets. With these outlets virtually closed the prices of farm products declined precipitously after 1929, and the farmer's purchasing power was reduced accordingly —his products could not be exchanged on a favorable basis for the products of industry. Nor did the chain of consequences stop there. Manufacturers who had always catered to the needs of the domestic market immediately noticed a diminution in the volume of their sales and found it necessary to dismiss workers no longer needed. When workers were thus unemployed their purchasing power was reduced—they had nothing to offer in exchange for food and other essentials. They were therefore unable to obtain or consume their usual quantities of the products that originate on the farm. In this way the general breakdown of the international exchange process reacted unfavorably upon the exchange process within our own borders, and adversely affected the farmer, the industrial worker, and all the other interdependent groups.

It should not be inferred that the policy of the government of excluding foreign goods at a time when we were a creditor country was alone responsible for the long depression which began in 1930.

Business itself was at fault throughout the latter part of the twenties in thinking that a new era was at hand. This attitude of mind contributed materially to the excesses of that period and to the ailments which followed. But the aggravated character of the depression was clearly the result of a governmental policy which insisted that the nation should eat its cake and have it too.

V

A great deal is known about all the other depressions we have had. What happened before, during, and after each of these dips in business during the past century is now a matter of record. It is unnecessary to select from this enormous mass of material, for illustrative purposes, any one example of a man-made depression. We have had so many depressions of that variety, and they have all had so much in common, that we need only indicate the course business has generally followed when left to its own devices and show how certain factors have led to unbalance.

Starting with a period when trade is stagnant and unemployment is general, we know from the record that recovery comes as a matter of course when such costs as rent, interest, and wages have been sufficiently reduced. These are the principal service charges that go to make the spread between the prices of raw materials and the prices of finished products. A reduction in this spread is the magic that starts recovery. A moment's reflection will show that when the spread has been reduced between the prices of wheat and bread, corn and bacon, cotton and cotton garments, wool and woolens, hides and shoes, pig iron and machinery, etc., the producer of raw materials will have a greater purchasing power—his products will exchange for a greater quantity of finished goods and he will begin to stock up.

Noting the improvement in the outlet for their products after costs have been reduced, and sensing the opportunity to make profits, manufacturers buy more raw materials, employ more workers, and increase their production. The greater industrial demand for raw material causes the prices of these products to rise, and rising prices give a new fillip to the purchasing power of raw-material producers. Similarly, the employment of more

workers in manufacturing industries revives the purchasing power of factory employees. They become able once more to buy the products of various industries. In response to this stimulus industry again increases its purchases of raw materials and employs more workers. In this way revival spreads out from group to group in an ever widening circle. Goods readily exchange for goods and the markets are cleared. Confidence is restored. The race for more profits is on.

At length various stresses begin to make their appearance, stresses that eventually lead to unbalance. Because of the profits that appear on the books of farmers, merchants, and manufacturers with the return of prosperity and rising prices, all are inclined to expand their operations. Money is borrowed in order to make plant extensions and to carry larger stocks of goods. Consumers also borrow to buy and to build. As the demand for labor increases, wages rise. Employers are induced to give in to excessive wage demands because there is no longer a redundancy of labor, because their profits are good and labor knows it, and because the outlook seems promising. With the disappearance of an unemployed class and the rise in wage rates, labor efficiency wanes so that the cost of labor rises more rapidly than the rise in wage rates. As old rental contracts expire, employers are obliged to renew their leases at higher rents and, as business expands, they must pay higher interest rates on a continually growing volume of borrowing. Costs are further enhanced by the fact that equipment which is obsolete and plants which are improperly located are again brought into operation. In one way or another numerous wastes make their appearance when profits come easily and management becomes complacent.

This process of piling up costs and of borrowing for expansion purposes because profits are good cannot go on indefinitely—for the simple reason that the supply of bank credit is limited. Long before the supply of credit approaches exhaustion interest rates rise. Weak borrowers are given closer scrutiny by the banks. As interest and wage costs continue to rise, the time comes when the profit margins of these borrowers are in danger and they are forced to become freer sellers in order to satisfy their bankers.

Forced selling of this sort adversely affects the profit margins of stronger borrowers as well, and they, too, may become suspect with their bankers. The stresses and strains which have been built into the business structure through increased costs eventually culminate in a period when profit margins disappear and goods must be sold to liquidate bank loans. Inasmuch as business costs are too inflexible to be reduced forthwith, there follows of necessity a period of declining prices, unemployment, impaired purchasing power, and stagnant trade. The route that was traversed by the forces of recovery after costs had been reduced is now traveled in reverse by the forces of depression because of the unbalance created by excessive costs.

According to the record, a severe credit strain, accompanied by high interest charges, has been the usual preliminary to all major depressions. But credit strain is not a necessary preliminary to declining profit margins and serious business recessions. We know that the building-up of any inflexible cost to an abnormal or arbitrary level may throw the exchange process out of balance and provoke the conditions which lead to depression.

The conclusion to be drawn from the record of man-made depressions is that with human beings constituted as they are, business profits—and aleatory wage rates as well—sow the seeds of their own destruction. The businessman, whether farmer, manufacturer, or merchant, expands his operations on borrowed funds when he is earning profits, and in so doing he incurs heavier expenses for interest, wages, and other inflexible costs. This cycle is repeated again and again, so long as profits are favorable. As the result of borrowing to buy, prices rise, and the rise in prices so increases the businessman's capital requirements that he must borrow more and more. In the course of this cycle of rising prices, rising wages, and rising interest rates, the spread between raw-material and finished-product prices becomes so wide that goods cannot readily be exchanged for goods or, as the businessman would express it, profit margins are in danger. The moment a situation of this kind is sensed the business community rushes for cover, each one for himself. Prices decline precipitously. Even after the wave of selling has subsided, there is a surplus of raw

material and finished products to be disposed of, a surplus growing out of the fact that markets cannot be cleared so long as the exchange of goods for goods is blocked by high costs. The purpose of the depression which follows is to force business to cut its costs so that the normal processes of exchange can be restored.

VI

Why, it may be asked, should intelligent businessmen become so complacent in periods of prosperity that they allow their costs to get out of bounds? Why are they misled into thinking they can afford to borrow money to extend their plants and carry larger stocks of goods, to pay higher and higher wage rates in response to labor demands, or to renew maturing lease contracts at higher and higher rentals—when all experience shows that a large portion of the profits which actuate them to make these commitments is subsequently lost?

To the extent that the answers to these questions lie in human nature we need pry no further. But a great deal more than human nature is involved. We have known all along that the profits system was somehow or other to blame for the excesses of prosperous periods. Just why this should be so we could not say. Recently we have had the wit to find the real explanation. Specifically, we have discovered that when the accepted rules of accounting are followed during a period of rising prices—and recovery from depression has invariably meant rising prices—the profits statement of every business which buys products for resale or for manufacture and resale will contain profits that are fictitious and unexpendable. These are the profits that mislead businessmen and cause most of the trouble.

Suppose, for example, that a manufacturer, wholesaler, or retailer has on hand a stock of goods costing one million dollars. As he sells these products he must replace them in order to be able to take care of the requirements of his customers. In a year of rising prices he will be able to obtain higher and higher prices for his products, but he will also find that he must replace his inventories at a higher and higher cost. If prices rise, say 10 per cent in the course of a year, the year's income statement prepared in

accordance with the accepted rules of accounting will contain an inventory profit of one hundred thousand dollars over and above any cash profit that may have been earned. The profit on inventory does not take the form of cash at all. It is represented in the accounts by the higher valuations placed on the stocks of goods on hand.

There is no way in which the businessman can realize these inventory profits in cash except by selling the assets and goodwill of his enterprise to some other operator and then retiring from the field. If he follows the usual course and remains in business, he cannot sell his inventories for cash and withdraw the cash from the business. He must maintain a normal supply of products on hand if his customers are to be retained—just as there must always be water in the mains if the householder is to be able to draw water from the kitchen tap. There is no legerdemain by which inventory profits can be spent for new plant, wages, taxes, or dividends. They must be allowed to remain in the business in the form of high-priced products to await the time when they will disappear automatically as the result of falling prices. Their sole purpose in a going business is to preserve the working capital of the owner by protecting him against subsequent inventory losses.

Unfortunately, businessmen have not appreciated these fundamentals—and only a few appreciate them today. In the period of rising prices which normally marks the emergence from depression the businessman notes with satisfaction the condition of his profits statement. On the strength of the increased profits that appear on his books—a large portion of which is the inventory appreciation that comes from rising prices—he expands his business on borrowed funds, buys more raw material, willingly responds to the demands of labor for higher wages, and in countless ways allows his operating costs to rise. The fact that he does not have as much cash as his income statement would indicate is no deterrent, because money can be borrowed to provide the cash.

The scramble to borrow money for the purpose of spending profits which do not take the form of cash is invariably the order of the day in periods of rising prices. And it is this spending that is largely responsible for the chain of rising prices, inventory

profits, more spending, more rising prices, and still more inventory profits. The realization that business at such times is spending borrowed money rather than profits does not occur. When costs have risen to the point where unbalance is created, prices fall and inventory profits disappear as unexpectedly as they came, leaving only a trail of debt to mark their exit. The debts contracted in periods of high prices must then be paid off out of cash earnings when prices are low. Little wonder that business depression is the incubus of the debtor classes.

How different the record of our depressions would be if business had realized the nature of inventory profits, or if the rules of accounting had been so devised and applied that they permitted only expendable profits to appear. Businessmen would not have been misled so repeatedly by their profits statement. They would not have had the same urge to borrow and expand in good times on the strength of fictitious earnings, only to find themselves saddled with debt and losses later on. Knowing the real condition of their profits, they would not have scrambled to buy stocks of goods in periods of recovery, only to set into operation the spiral of rising prices and ephemeral inventory profits, ending finally in collapse. They would have resisted more vigorously the payment of wage rates that produced subsequent unemployment, and of dividends that had the effect of misleading investors. In short, business would have been far more stable.

It should not be inferred that the substitution of expendable profits for fictitious profits as a guide to business activity would keep business on an even keel. There is still the human factor to be reckoned with. Human beings instinctively attach more importance to the present than to the future. Moreover, they are gregarious. They have their group moods of fear or optimism. To these variables must be added the uncertain policies of government which can excite or depress business on short notice. Human nature and government policies dictate that we should still have periods of mild expansion and contraction, however perfect the profits guide could be made. But it stands to reason that the elimination of false profits would go a long way toward keeping our complex productive and exchange system in better bal-

ance, and in preventing extreme depressions. Until such profits are recognized for what they are, it is a certainty that little if any progress will be made in smoothing the course of business.

VII

To point out the principal causal factor in man-made depressions is to suggest the remedy. What the business community obviously needs is a new definition of profits and an accounting technique which will keep fictitious and unexpendable gains out of the profits statement. We know the accounting procedure that will give the desired results. A few large companies are already using it as a guide to sounder policies. The real difficulty is to get the new technique adopted by the business community as a whole. The average businessman is too steeped in the old definition of profits to make any change voluntarily or to have an open mind on the subject. He will accept the newer concept of profits only when he is ordered to do so by some higher authority.

In these circumstances one would naturally expect the United States Treasury, which is vitally interested in the question of business profits for taxing purposes, to take a constructive stand in favor of accounting reform. But, curiously enough, this department of the government is a hindrance rather than a help. Again and again the Treasury has been asked by prominent business corporations to permit them to report as taxable income only their expendable profits, but as often as such requests have been made they have been refused—on the ground that the Treasury must adhere to the definition of profits prevailing in the particular industry. (Parenthetically, it should be noted that these requests have usually been made in periods of prosperity when compliance would have meant a reduction in income-tax revenue.) So long as the Treasury holds to this position there is little likelihood that many businessmen will complicate their affairs by adopting a definition of profits which is not valid for tax purposes, or that bankers, without a new Treasury ruling to educate and bolster them, will insist on examining a statement of the real profits of borrowers as a condition for the granting of loans. Unfortunately the educational example which both businessmen and bankers

need, if the profits guide is to be made dependable, is not forthcoming.

Another obstacle to reform, no less paradoxical, is the taxing policy of the federal government itself. After the corporation-income tax has taken its toll from corporate profits, whether cash profits or unexpendable profits, the undistributed profits-tax law, first applied in 1936, imposes an onerous tax on the reported profits not paid out in dividends. This innovation in tax legislation is an obstacle of the first magnitude to the popularization of the newer concept of profits. Even if all corporation directors were cognizant of the fact that inventory profits are fictitious, ephemeral, and unexpendable, and should be conserved as a protection against future inventory losses, they would be unable to do anything about it. Try as they might, they could conserve only a portion of such profits, and then only at terrific cost. As matters now stand, those who have inventory gains in their profits statements must choose between borrowing the money to meet a higher tax bill—an alternative which is anathema to shareholders—or borrowing to pay larger dividends. Since the enactment of the undistributed profits-tax law, the general practice has been to avoid the tax penalty by paying out more in dividends.

The failure of the federal government to recognize the fundamental difference between cash profits and inventory profits and the penalty it imposes on the conservation of profits will have serious consequences for everyone. In practice a corporate surplus is a general reserve against all sorts of contingencies—losses due to fire, flood, etc., operating losses arising from the competition of more efficient firms, inventory losses resulting from severe price declines, and a host of other contingencies. In the case of most industrial and trading corporations a substantial part of the surplus account is simply a reserve against declining prices and inventory losses whether so intended or not. In times past these reserves cushioned the decline of prices and employment in a burgeoning depression. Financially strong companies did not close their factories the moment business became bad, or dismiss workers immediately, or discontinue dividends forthwith. They could carry on in the face of current losses for a considerable

period of time, hoping to weather the storm without loss of prestige or trade position.

A few years more of the undistributed profits-tax law and these traditional functions of the surplus reserve will vanish—if they have not already. Business corporations will not have the financial strength to maintain their operations, employment, or dividends during lean periods. Having paid out more in dividends and taxes than their cash profits amounted to, they will be obliged to pull in their sails promptly when there is the suggestion of trouble ahead. The scramble for safety at such times should aggravate group fear and unbalance. It should have the effect of bringing on more precipitous declines in prices and production, more inventory losses and unemployment, and more serious depressions than we have had.

This brings us face to face with a final paradox. No government has ever shown so much interest in searching for a preventive of depressions or spent so much money in a recovery program as the government we have had since 1932. At the same time no government, with the possible exception of those we had during the twenties, has followed policies so destined to create and aggravate unbalance in the economic system. Having reached the stage in our understanding of profits where there seemed to be more than a ray of hope that the severity of man-made depressions could be avoided, we are unable to put a reasoned policy to the test because of the counterpolicies of the federal government itself. This changes, for the time being, the whole complexion of our problem. The immediate problem is to find some way of preventing depressions of the government-made variety.

INDEX NUMBERS AND PUBLIC UTILITY PROPERTY VALUATION

FRANK A. MANCINA[1]

LITIGATION involving public utilities emanates from two sources: (*a*) a utility acting in its own behalf, and (*b*) a consumer or a regulatory body acting presumably in the interests of the public. Most frequently the objective on the part of the public utility is a reasonable return on investment; on the part of the regulatory body the objective is a lower cost of service to the public.

A public utility is allowed to earn its operating expenses, depreciation expenses, and a "fair" return on "fair" value of property. To this latter, a "fair" return of "fair" value of property, may be traced the major portion of utility litigation. The concept of "fair" value of property must embrace both the historical and present cost of property, tangible and intangible, and the accrued depreciation thereon. This study has been limited to that part of the "fair" valuation of public utility properties which is physical plant and equipment.

Since the case of *Smyth* v. *Ames*,[2] the Supreme Court of the United States has emphasized the reproduction cost method of arriving at the valuation of public utility properties. "Reproduction cost, in the usually accepted meaning of the term, is the amount that would have to be expended now in the construction of the properties included in the rate-base."[3]

The usual method of arriving at a reproduction cost valuation of utility property is by means of a field appraisal conducted by a reputable appraisal engineering firm. Since 1918,[4] utilities have

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[2] 169 U.S. 466.

[3] W. J. Graham, *Public Utility Valuation* (Chicago: University of Chicago Press, 1924), p. 3.

[4] In 1918 the Illinois Bell Telephone Company conducted, by the use of index numbers, an appraisal of the Indiana Portion of their Suburban Division proper-

been, in a number of instances, obtaining reproduction cost value of property by the use of index numbers. They apply index numbers to the cost of initial plant[5] and to subsequent additions; from this sum they deduct retirements also adjusted to a reproduction cost, and thus obtain the reproduction cost value of the present plant. It is this use of index numbers in determining the reproduction cost of physical property with which this study is concerned.

THE INDEX-NUMBER METHOD[6]

The index-number method may be described briefly in the following manner. The cost of the initial plant and the expenditures for construction in each of the subsequent years are adjusted to the price level of the year for which valuation is desired, by application of certain index numbers known in engineering terminology as "cost conversion factors." These factors convert the expenditures for plant in any given year to the level they would have attained had the plant been built during the year for which valuation of property is being determined. From the sum of the value of the initial plant and the subsequent additions, both adjusted for the level of prices, is deducted the similarly adjusted value of the retirements, and in this manner the reproduction cost valuation of property before depreciation is obtained.

An index of construction costs must necessarily include changes in both materials and labor costs. Furthermore, the index must

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ty. As far as it was possible for the writer to ascertain, this was the first time index numbers were used in the valuation of public utility properties.

[5] The term "plant" as used in this study means the equipment or property included under a fixed-asset account title.

[6] The material for this portion of the study was gathered from the evidence in two rate cases: (*a*) *Illinois Bell Telephone Company* v. *Moynihan, Trobillion et al.*, District Court of the United States, Northern District of Illinois, 1929; and (*b*) *Illinois Bell Telephone Company* v. *Gilbert, Kuhn et al.*, District Court of the United States, Northern District of Illinois, 1932.

A careful study was made of the testimony of Mr. William F. Sloan which appears in Volumes I, II, and III of the abstract of record in the first case; also, Volumes I and IV of the abstract of record in the second case. Mr. William F. Sloan is one of the partners of Sloan and Cook, Consulting Engineers, 120 South La Salle Street, Chicago. This firm conducted the appraisal of the Illinois Bell Telephone Company property in both rate cases.

deal individually with the total plant as it existed at the beginning of the period being measured, gross additions to plant during the period, and retirements from plant during the period. For, as will be shown later, these are of a significantly different nature.

To facilitate presentation of the method, the Illinois Bell Telephone Company Exchange Pole Line Account[7] cost conversion factors, as calculated by Mr. William F. Sloan, will be used as illustrations.

Material cost conversion factor for total plant.—A representative sample of items[8] at any given date was obtained from the plant measurement records of the Illinois Bell Telephone Company. The items representing the cross-section were priced as of the beginning and as of the end of the year, that is, they were priced as of December 31 of one year and December 31 of the next year. The prices of materials were obtained from the price quotations of the Western Electric Company, from whom the Illinois Bell Telephone Company purchases its materials.

Table 1 portrays the method by which the Exchange Pole Line Account total plant conversion factors for 1924 were obtained. The quantities of each item of plant are exactly the same as the quantities appearing in the plant measurement records, except that they have been divided by a constant factor to eliminate the insignificant items and at the same time simplify subsequent computations. The quantities are for the year 1923. These quantities of plant are multiplied by the year-end 1923 price and by the year-end 1924 price. The ratio of total material cost as of December 31, 1924, to total material cost as of December 31, 1923, is the 1924 conversion factor for the material portion of the Exchange Pole Line Account total plant.

Material cost conversion factor for gross additions to plant.—Table 2 illustrates the computation of the cost conversion for the

[7] The Exchange Pole Line Account is Account 241 in the Interstate Commerce Commission classification of telephone utility property accounts. This account is made up of various sizes and classes of poles upon which aerial wires or cables are suspended. The account also includes items of auxiliary plant, such as guard arms, anchors, strand, and cross-arms.

[8] Hereinafter referred to as a "cross-section."

material portion of the gross additions in the year 1924 to the Exchange Pole Line Account.

The gross additions during a given year might be somewhat different from the kinds and quantities of items that were in

TABLE 1

ACCOUNT 241: EXCHANGE POLE LINES—MATERIAL COST TREND—TOTAL PLANT 1924*

Description	Unit	Quantity	Total Cost Dec. 31, 1923	Total Cost Dec. 31, 1924
Class B poles northern white cedar:				
30 ft.	each	5.3	$ 74.68	$ 56.60
35 ft.	each	32.9	626.74	561.27
40 ft.	each	17.2	387.69	338.50
45 ft.	each	3.1	87.11	73.41
50 ft.	each	1.2	36.54	31.02
Class B poles western red cedar:				
30 ft.	each	0.2	3.45	3.36
35 ft.	each	1.4	28.01	27.13
40 ft.	each	0.4	9.45	8.92
45 ft.	each	0.1	2.83	2.55
50 ft.	each			
Total			$1,256.50	$1,102.76
Pole yard charges			$ 223.28	$ 133.88
Guard arms	each	100.1	60.12	53.91
Anchors	each	11.2	7.86	7.02
Strand—6M	foot	448.2	7.92	6.42
Cross-arms, 10 pins	each	12.9	15.61	15.35
Total			$1,571.29	$1,319.34
Supply expense			111.09	71.38
Total material cost			$1,682.38	$1,390.72

Ratio Dec. 31, 1924, to Dec. 31, 1923 ..... 82.66 per cent

* Source: *Cost of Reproduction of Property, Illinois Bell Telephone Company, Chicago Area, Dec. 31, 1924.*

existence at the beginning of the year; therefore, gross additions for a year were analyzed and the proportions of the various sizes and kinds of plant that were erected in that year were determined. Instead of using the two year-end prices of valuing these addi-

tions, the average cost for the year 1924 was used because the additions occurred through the year. Then they were priced again at the 1924 year-end price. The ratio of total material cost as of December 31, 1924, to average 1924 total material cost is the conversion factor for the material portion of the gross additions for the year 1924 to the Exchange Pole Line Account.

TABLE 2

ACCOUNT 241: EXCHANGE POLE LINES—MATERIAL COST TREND—GROSS ADDITIONS, 1924*

Description	Unit	Quantity	Average Cost (1924)	Cost Dec. 31, 1924
Class B poles:				
30 ft.	each	0.2	$ 3.40	$ 3.36
35 ft.	each	3.0	59.07	58.14
40 ft.	each	0.7	16.30	15.62
45 ft.	each	0.2	5.63	5.09
Total			$ 84.40	$ 82.21
Pole yard charges			$ 11.06	$ 9.98
Cross-arm, 10 pin	each			
Guard arms	each	6.6	3.55	3.55
Anchors	each	0.7	0.45	0.44
Strand—6M	foot	28.0	0.41	0.40
Total			$ 99.87	$ 96.58
Supply expense			5.39	5.22
Total material cost			$105.26	$101.80
Ratio Dec. 31, 1924, to yearly average				96.71 per cent

* Source: *Cost of Reproduction of Property, Illinois Bell Telephone Company, Chicago Area, Dec. 31, 1924.*

Labor cost conversion factors for total plant and gross additions.—To obtain the average number of employees and wages paid, the company's pay-roll records were analyzed. This analysis yielded a typical construction gang to be used through all the years for both the total plant and the gross additions. The use of a typical construction gang is theoretically incorrect, for it measures only the wage-level change. A method by which a labor index may be constructed so that it will measure changes in both wages and

labor performance will be presented in a second article, to be published in this *Journal*.

The services of this typical construction gang were priced at the December 31, 1923, average 1924, and December 31, 1924, wage-rates paid by the Illinois Bell Telephone Company (Table 3). The ratio of total gang cost as of December 31, 1924, to total

TABLE 3

ACCOUNT 241: EXCHANGE POLE LINES
LABOR COST TREND, 1924*

DESCRIPTION	QUANTITY	TOTAL COST AT AVERAGE MONTHLY RATES OF PAY		
		Dec. 31, 1923	Year 1924	Dec. 31, 1924
Line gang:				
Foreman	1	$ 191.50	$ 194.11	$ 195.50
Linemen	3	465.00	478.35	465.00
Groundmen	1	107.50	111.88	110.50
Driver	1	107.50	111.88	110.50
Total		$ 871.50	$ 896.22	$ 881.50
Directed supervision		171.95	162.40	159.73
Total		$1,043.45	$1,058.62	$1,041.23
Plant supervision and tool expense		85.88	115.07	112.97
Truck cost		222.56	205.92	224.64
Total line gang		$1,351.89	$1,379.61	$1,378.84

Ratio Dec. 31, 1924, to Dec. 31, 1923 ..... 101.99 per cent
Ratio Dec. 31, 1924, to yearly average ..... 99.94 per cent

* Source: *Cost of Reproduction of Property, Illinois Bell Telephone Company, Chicago Area, Dec. 31, 1924.*

gang cost as of December 31, 1923, is the labor cost conversion factor for the Exchange Pole Line Account total plant. The ratio of total gang cost as of December 31, 1924, to total average gang cost for the year 1924 is the labor cost conversion factor for the 1924 gross additions to the Exchange Pole Line Account.

Composite labor and material cost conversion factors for total plant and gross additions.—The proportions of labor cost and ma-

terial cost in the total cost of gross additions for a given date were determined from the company records. Then the conversion factors of material costs and labor costs were merged into a composite material and labor cost factor by the following method, which is illustrated by Table 4.

TABLE 4

ACCOUNT 241: EXCHANGE POLE LINES COMPOSITE MATERIAL AND LABOR COST TREND*

	Percentage
TOTAL PLANT	
Ratio 12/31/24 to 12/31/23 cost of material	82.66
Ratio 12/31/24 to 12/31/23 cost of labor	101.99
Ratio 12/31/24 to 12/31/23 cost of Commonwealth Edison Company joint construction	100.00
Percentage of total cost—material	52.00
Percentage of total cost—labor	41.50
Percentage of total cost—Commonwealth Edison Company joint construction	6.50
Ratio Dec. 31, 1924, to Dec. 31, 1923, cost of material and labor	91.81
GROSS ADDITIONS	
Ratio 12/31/24 to 1924 yearly average cost of material	96.71
Ratio 12/31/24 to 1924 yearly average cost of labor	99.94
Ratio 12/31/24 to 1924 yearly average—Cost of Commonwealth Edison Company joint construction	100.00
Percentage of total cost—material	31.90
Percentage of total cost—labor	29.70
Percentage of total cost—Commonwealth Edison Company joint construction	38.40
Ratio 12/31/24 to 1924 yearly average cost of material and labor	98.93

* Source: *Cost of Reproduction of Property, Illinois Bell Telephone Company, Chicago Area, Dec. 31, 1924.*

The conversion factors 0.8266 and 1.0199 are carried forward from Table 1 and 2, respectively. The composite for the total plant is 52 per cent (proportion of material cost) of 0.8266 plus 41.5 per cent (proportion of labor cost) of 1.0149. In this instance, some poles—6.5 per cent, to be exact—were erected jointly with the Commonwealth Edison Company. This is also added into the sum above, resulting in the composite conversion factor

91.81 per cent. This conversion factor is to be used in obtaining the reproduction cost value as of December 31, 1924, of poles in existence as of December 31, 1923. Similarly, the ratio 0.9893 is the composite cost conversion factor for carrying forward 1924 gross additions to the December 31, 1924, level of cost.

Retirements conversion factor.—Retirements during a given year were credited to the proper account in an amount commensurate with the average book cost as of December 31 of the previous year. The adjusting factor by which retirements must be multi-

TABLE 5

ACCOUNT 241: EXCHANGE POLE LINES RETIREMENT CONVERSION FACTORS, 1924*

Book cost, including capitalized overheads, of plant in service 12/31/23	$2,223,099
Appraisal cost, at Dec. 31, 1924, cost level, exclusive of capitalized overheads, of plant in service 12/31/23	$3,097,377
Ratio of 12/31/24 cost to book cost (per cent)	139.33

* Source: *Cost of Reproduction of Property, Illinois Bell Telephone Company, Chicago Area, Dec. 31, 1924.*

plied in order that they will be credited at reproduction cost value is the ratio of the reproduction cost of plant as of December 31, 1923, to the book cost of plant as of December 31, 1923 (see Table 5). However, the conversion factor for retirements is the ratio of the book cost, including overheads, to the reproduction cost, excluding overheads.[9] This is done to eliminate the overheads that have been charged to retirements on the books. Overheads are not to be brought forward to a reproduction cost level. They are charged in as a flat percentage determined for each of the years for which reproduction cost is desired. The initial outlay for plant and subsequent additions to plant must be analyzed and the overheads eliminated.

The various cost conversion factors are applied in the following manner. The cost of total plant as of December 31, 1923, was multiplied by the composite labor and material cost conversion

[9] Overhead consists of legal expense, engineering expense, administrative expense, and taxes and interest during construction.

factor for total plant. The sum of the gross additions to plant for the year 1924 was multiplied by the composite labor and material cost conversion factor for gross additions. From the sum of the figures so determined was deducted the plant retirements similarly adjusted, which resulted in a figure representing the net cost of reproduction of the Exchange Pole Line Account as of December 31, 1924.

To illustrate, assume that the reproduction cost value of the Exchange Pole Line Account as of December 31, 1923, was $1,000,000, and let this be represented by the letter A. Assume, further, that during the year 1924 the books show $20,000 of gross additions (represented by the letter B) and $10,000 of retirements (represented by the letter M). Furthermore, let the conversion factor for total plant, gross additions, and retirements be 0.9181, 0.9893, and 1.3933, respectively; these are to be represented by the letters a, b, and m, in the order named. The equation for obtaining the net reproduction cost value of the Exchange Pole Line Account (represented by the letter R) as of December 31, 1924, would be

$$(A \times a) + (B \times b) - (M \times m) = \mathrm{R} .$$

Substituting the numerical values for their respective letters, the reproduction cost value of the Exchange Pole Line Account as of December 31, 1924, is

$$(\$1{,}000{,}000 \times 0.9181) + (\$20{,}000 \times 0.9893) - (\$10{,}000 \times 1.3933) = \$923{,}953 .$$

This procedure must be gone through separately for each asset account on the books of the utility for which reproduction cost is being determined. Each account will yield a figure similar to the $923,953. The sum of all these similar figures will be the reproduction cost value of all physical property of the utility being appraised.

RELIABILITY AND LIMITATIONS OF THE INDEX-NUMBER METHOD

No one will deny that an appraisal based upon index numbers can be made much more expeditiously and at a fraction of the

cost of similar work done by the field-inventory method. Many, however, will question the accuracy of an appraisal based on index numbers.

If the price quotations used were correct and the quantity of each item of plant accurately measured, the resultant valuation would be 100 per cent accurate. Both the index-number method and the field-inventory method will necessarily be equally accurate as far as commodity prices are concerned. The problem of the reliability of the index-number method resolves itself into one of determining the difference between the valuation of property as determined by the field-inventory method, based on all items of plant, and the valuation arrived at by the index-number method, based upon sample items of plant. If this difference is relatively small, field appraisals should, in many instances, make way for appraisals prepared by the use of index numbers.

The question involved is how well may one expect index numbers to represent accurately price changes.

> The accuracy of index numbers as an expression of price changes in a defined group depends on three conditions:
> 1. Relative importance assigned to commodities so that in the aggregate they shall represent faithfully the whole of the transactions in the group;
> 2. Method by which the price changes are combined;
> 3. Inexactness that arises from the fact that in nearly all the cases the price changes used are a sample of all the price changes that exist.[10]

The third condition, proper sampling, is the most important of the three. However, fundamentally conditions (1) and (3) overlap.

In the index-number method, the choice of items included in a cross-section is not a random one but one made by purposive selection, including in the sample only the more typical items.

Upon examination of the utility's plant measurement records a list of all items of plant can be made. This list is supplemented with the price of each item of plant. Then, after a careful examination of both price and quantity, the more typical items are

[10] Arthur L. Bowley, "The Influence on the Precision of Index-Numbers of Correlation between the Prices of Commodities," *Journal of the Royal Statistical Society*, March, 1926, p. 300.

chosen as a representative cross-section. Not only these items but auxiliary items necessary to supplement the original cross-section are included.

To illustrate, aerial cable would not be aerial cable unless there was a proper amount of steel strand to support it. So, into the Exchange Aerial Cable amount sample must be placed an amount of steel strand that is commensurate with the footage of aerial cable. In the Exchange Underground Conduit Account are listed manhole covers—some 24 inches and some 27 inches in diameter. After the proper proportions of each cover have been determined, there must be added enough cement, brick, and sand to take care of all the manholes represented by the covers, plus an amount of these materials necessary for the conduit trench.

There are two implicit assumptions in the index-number method. These are, first, accuracy of the plant measurement records and, second, the selection of a representative cross-section.

In the larger utilities the first is invariably present. It is the smaller companies that do not keep accurate detail on inventory. In these smaller companies a field count of items of plant must be made to avoid unnecessary and expensive litigation. From there on, the entire list of items may be priced out as they would be if the inventory method were used. If the numbers of items are large, then a proper selection of the cross-section may be made and the index-number procedure followed. The first assumption, accuracy of records, is present in the larger utilities, but rarely in small utilities.

The second condition, selection of a proper cross-section, is a function of both the accuracy of the plant measurements and the experience of the person conducting the appraisal. Only a thorough knowledge of the property being measured will enable one to choose the more representative items of plant and to supplement them with proper amounts of auxiliary plant.

If the cross-section of plant used is truly representative of plant, then the reproduction cost value of plant arrived at by the index-number method is exactly the same as the reproduction cost value of plant based on the entire list of items of plant.

A representative cross-section of plant is one that includes

sample items the prices and quantities of which, on the average, fluctuate relatively in exactly the same manner as does the plant which the sample is to represent.

The reliability of a cross-section may be approached in a negative manner. As a measure of the degree of reliability, the standard error of an index number may be used. By "standard error of an index number" is meant that error which arises from the fact that a cross-section, and not the entire account, has been measured. This error does not measure any inherent bias that will lead to too high or too low a reproduction cost value of plant.

The standard error of the index number may be calculated by methods presented in texts on statistical methods or articles on the precision of index numbers.[11] This standard error measures only errors arising from a random selection of the cross-section of plant. If there is reason to believe that the cross-section chosen at random is not as good a selection as the cross-section obtained by a careful study of all items of plant and the subsequent choice of the more typical items, the standard error obtained will be too large. The error of the random sample may be used as the upper limit of the error of the stratified sample, and it may be said that the cross-section has an error less than that which has been calculated. The alternative method by which a purposive selection of items may be tested as to errors of sampling is by direct comparison with the entire account. This entails two appraisals—one by index numbers and the other by a complete inventory of plant. This is, however, out of the question; the reason index numbers are used in appraisals is to avoid the expense and the time necessary to conduct a field-inventory appraisal.

There is an upward bias in the index-number method. This is caused by the fact that costs under "piecemeal" construction are used to represent costs of complete reproduction of plant. In detail, the bias may be illustrated by the cost of labor. To build index numbers of labor cost for a period of years, the gross addi-

[11] Truman L. Kelley, "Certain Properties of Index Numbers," *Quarterly Publication of the American Statistical Association*, September, 1921, pp. 826–41; Arthur L. Bowley, *Elements of Statistics* (5th ed.; New York: Charles Scribner's Sons, 1926), pp. 312–42.

tions are analyzed and separated into material costs and labor costs. However, these labor costs represent cost not of reproduction of entire plant but of gross additions—some large and some small. Per unit labor cost varies inversely with the size of the unit installed. A large number of small construction jobs will reflect a per unit labor cost that is too high to represent the per unit cost of labor that would be experienced if the entire plant were to be reproduced. The labor factor calculated from the gross additions will overstate the true labor factor under reproduction cost, and consequently give too high a value of property. The method by which this error may be eliminated, in large part, is to relate the large estimates of any given year's gross additions to all gross additions, both large and small, of the preceding year.

An appraisal of utility property made by both the index-number method and the field-inventory method affords an excellent opportunity for a direct comparison between the two methods. The value arrived at was the reproduction cost value of plant as of December 31, 1925. The starting-point for the index numbers was 1919. In the interim period a great deal of reconstruction and plant extension work was done. The property was brought forward to the price level of December 31, 1925. At that time a field count was taken and priced out. The reproduction cost value of plant arrived at by the use of index numbers was 2.5 per cent higher than the reproduction cost value of plant arrived at by the field-inventory method.

MUNICIPAL WATER-UTILITY MANAGEMENT
Concluded

E. GROSVENOR PLOWMAN*

MANAGEMENT AT THE OPERATION LEVEL

DEPARTMENTATION IN GENERAL

THE actual departmentation of the water utility tends strongly toward the functional, except at the very lowest level of subdepartmentation, where the geographical dispersion of operating centers results in territorial control. There is, of course, some difference between the theoretical spread of a particular function and the actual spread of duties. There may be noted, however, a strong tendency to broaden the functional department's scope to include a larger percentage of the theoretical operation, as, for example:

1. The meaning of the term "purchasing," in a functional sense, is inclusive of all acts of purchase, both goods and services. In Denver, for example, even the services of temporary specialists are purchased through the purchasing agent. In some cities it is necessary to advertise for bids from such specialists just as if their services were a tangible commodity.

2. Engineering records, design of structures, inspection during construction, and approval after construction have been almost completely concentrated under the chief engineer in many water utilities.

3. Laboratory responsibility for water purity has, in recent years, been extended to the purification of newly constructed water mains before they are placed in service.

4. Control of the automobile fleet, its repair, housing, and allocation centralizes the function of transportation.

5. There is a tendency toward electrical and mechanical specialists—sometimes the same person—responsible for all electric wiring and mechanical equipment.

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6. Some water utilities, under their own civil service, have gone far toward a separate functional personnel department.

A detailed summary of the actual departmentation of typical water utilities bringing out clearly the tendency toward as complete a functional organization as possible is shown in Table 1.

The indentation in the summary indicates grouping of functional activities into administrative divisions or major departments. The term "independent" means that the office may exist but has no responsibility over the water utility.

These four water utilities are fairly typical of the major forms of organization under the council and mayor, under the water board, and under the utility board. Organization under the council and city manager is not shown. It resembles the council and mayor plan in its use of city departments as part of the water utility.

The major departmentation is very much alike, aside from the shifting of responsibility for top management. Baltimore has seven departments heading up under the city, and six heading up under the water engineer—a total of thirteen. Detroit has five departments heading up under the city, and five heading up under the general manager—a total of ten. Denver has five departments heading up under the city, and eight departments heading up under the executive assistant to the water board—a total of thirteen. East Bay has four departments having independent direct contact with the utility board, and eight departments heading up under the general manager—a total of twelve.

Disregarding the varied arrangements of functions into major departments, the summary indicates that the following functions are given more or less complete and separate recognition in all four of these water utilities: legal, handling of money and its safekeeping, auditing, civil service and/or personnel, purchasing, major construction, accounting, billing and collecting, customer service, minor construction, maintenance, engineering, filtration, purification, pumping—a total of fifteen functional activities covering the whole range of water-utility work.

The summary also indicates general agreement that the functions of legal advice and litigation, handling of money and its

TABLE 1

DEPARTMENTATION OF TYPICAL WATER UTILITIES

Baltimore	Detroit	Denver	East Bay (Oakland)
Organization of the Trusteeship Level of Management Activity			
City council Civil service commission Mayor	City council Civil service commission Mayor Water board	City council Civil service commission Mayor Water board	(Independent) (Independent) (Independent) Utility board
Organization of the Co-ordination Level of Top Executive			
Mayor City engineer Water engineer	Mayor (Independent) General manager	Mayor (Independent) Executive assistant	(Independent) (Independent) General manager
Departmentation Independent of the Water-Utility Top Executive			
Legal Treasurer Auditing Civil service Purchasing Major construction Accounting, including billing and collecting	Legal Treasurer Auditing Civil service Purchasing	Legal Treasurer Auditing Civil service Major construction	Legal Treasurer Auditing Accounting, including billing and collecting
Departmentation under the Water-Utility Top Executive			
Customer service	Personnel Major construction Business accounts and records	Personnel Purchasing Accounting, including billing and collecting Customer service Flat-rate inspection	Personnel Purchasing Major construction Customer service
Minor construction Maintenance Engineering Filtration and purification Pumping	Minor construction, maintenance and engineering Purification and pumping	Minor construction Maintenance, engineering, filtration, purification, pumping, conduits and reservoirs Water-rights administration	Minor construction, maintenance, filtration, purification and pumping General engineering Aqueduct maintenance and operation Land management

safekeeping, auditing, which may mean either the typical pre-audit of governmental agencies or the C.P.A. audit, or both, and civil service are kept independent of the general manager. In all four cases these functions are part of the direct province of the trusteeship level of management activity. This is because of their special nature. The legal function directly affects policies and strategy by means of which the trustees aim to accomplish their objectives. The treasurer and the auditor are properly independent because they check each other and operating management. The civil-service function involves the administration of a specialized protective law, and the law itself, by creating a civil-service commission, prevents delegation below the trusteeship level.

Operating functions, on the other hand, are defined by all four water utilities as being personnel, customer service, minor construction, maintenance, engineering, filtration, purification, and pumping. The difference between civil service and personnel will be discussed in the chapter on personnel. Customer service is a catchall function covering such matters as new connections with the mains, complaints and misunderstandings, turnoff and turn-on. There can be no doubt that it is an operating function.

Minor construction, maintenance, engineering, filtration, purification, and pumping constitute the group within which the subdepartmental level of organization along territorial lines takes place. Table 2 shows the actual organization of these functional activities in Denver.

Below this subdepartment level, at the level of foremanship and group supervision, the use of the territorial method of organization is even more common. This is because of the relatively large number of separate operating centers of permanent or temporary character. As a result, such a territorial-type foreman often finds himself supervised by several different functional specialists. Thus the foreman of one of the city pipe crews, for example, may receive an order to instal a particular pipe at a certain location. The specific measurements come from the engineering division, which also acts as inspector and checks the final measurements for preparation of its pipe maps; the pipe itself is delivered by the storage yard with its own truck and crew, giving

the foreman contact with another supervision center; and the pipe when installed is disinfected and flushed under the direction of the laboratory. Back of the orders of the engineering department are promises made by the customer-service division to instal such a pipe. The records indicating installation must go not only to the engineering division but also back to the customer-service division and to the billing and collection division.

TABLE 2

TYPICAL SUBDEPARTMENTATION, DENVER WATER UTILITY

Manager of Construction	Chief Engineer and General Superintendent
Auto transportation, including repair	All engineering, except major construction
All building, construction and maintenance	All filtration and purification
	Street mains and valves, maintenance and operation
	Pumping
	Electric wiring and equipment
Territorial	
Central storage, garage and shops area, including shop services	Reservoir 1
	Reservoir 2
	Reservoir 3
	Conduits maintenance and operation outside city
	Conduits maintenance and operation inside city

The principal functions of departmental character that sometimes are placed directly under the trusteeship level, and sometimes placed under the top executive of the water utility, are purchasing, major construction, and accounting—including billing and collection. In the four water utilities compared these functional departments are equally divided between the two.

The argument in favor of using the purchasing organization of the general city government is, of course, the function viewed from the standpoint of the entire city. It is pointed out that the purchases of the water utility, added to those of the city, will provide even larger volume with which to bargain for quantity dis-

counts, will permit reduction in varieties of articles purchased, thus permitting mass production and reduction in the city's investment in inventory, and will permit more intelligent and detailed study of sources of supply and of qualities offered as compared with specifications. Against these forceful arguments there is presented by the water utility the claim that the variation between typical city and typical water-utility purchases is so great as to reduce the possible economies of consolidated buying, that emergency needs require carrying of an inventory directly under the control of the water utility, eliminating possible savings through reduction in total inventory, and that sources of supply for water-utility materials commonly charge more, that is, offer a lesser discount to the purchasing agents of cities than to the purchasing agents of water utilities.

Major construction is apparently also evenly divided. Actually the trend is strongly toward complete separation of this functional activity. In Detroit the major construction indicated in Table 1 was being carried on by an almost completely separate organization—even to having its own accounting organization—specialized in the accounting problems incident to bond funds and large numbers of temporary workers. In East Bay the chief engineer and general manager was selected in part because of his ability in handling major construction. His responsibility was for design and inspection, the work itself being contracted.

Much the same can be said of accounting, including billing and collection. Although apparently evenly divided in the sample of four water utilities studied in detail, there is, even in Detroit and Denver, pressure exerted by the charter relations with the city auditing and accounting department that makes for independence. In Denver the judgment of an outside accounting expert was that better organization would be obtained and fewer functional difficulties would appear if this independence were even further recognized. He urged that differences of opinion between the head of the accounting department and the top executive be arbitrated by the water board itself—this would automatically grant autonomy to the accounting function and place it directly under the water board.

OBJECTIVES AND POLICIES

The objective of a water utility is to render a satisfactory water service to the individual citizens of a particular community. For generations the typical metropolitan water utility has been swamped with the problem of its own expansion to keep up with rapid population growth—rapid expansion of the geographical area within which it was supposed to render service and rapid increase in the variety and amount of service rendered per capita. This led to the strategy of concentrating available funds and available personnel upon the task of physical expansion of the water utility, leaving the office to lag behind with little attention.

Now that population growth has begun to slow down, water utilities have been enabled to catch their breath and to view their problems more broadly. The result is a new point of view which may be called the strategy of performance of all necessary services at the optimum balance between cost and value to the citizen-customers.

Some water utilities have much more stable and effective management committees than others. The natural trend of any plural executive under the pressure of reality would seem to be toward proper fulfilment of direct obligations, and proper delegation of responsibilities and duties to others. The experience in the case of the Denver water board, for example, has been away from inexperience and instability, toward experience, stability, and effectiveness. The principal effects of the degree of stability of the trusteeship committee upon operation are, from observation of several cases, apparently as follows:

1. Under conditions of instability of the trusteeship committee, policies, once established, are not persevered in unless of extremely basic character, such as working toward a new water-supply source under the incentive of recurring water shortages. The reverse, of course, develops along with the trend toward stability of the management committee.

2. Similarly, under conditions of instability of the committee, delegation of authority is notably restricted, erratic, and is often granted for temporary periods and then suddenly withdrawn. The trusteeship committee, in other words, contributes markedly

to its own instability by overloading itself with the minute details of management. Everything must come before it. Again the converse is true as stability develops—the board under such circumstances conferring a similar sense of stability upon its executives by well-defined and reasonable delegation of the fullest possible measure of the authority that has already been defined as of "co-ordination" type.

3. There seems to be a strong trend, under conditions both of stability and of instability of the trusteeship committee, to move toward more use of force account, shops, maintenance, and construction—in other words, toward greater self-containment. The arguments of better use of the worker's time, lower costs through not having to pay a profit to outsiders, and advantages of larger equipment in meeting emergencies seem to appeal to all types of trusteeship committees.

In private business the profit motive is thought of as the dominant objective to which all others can be related. In public business the objective commonly accepted is satisfactory service. All policies can ultimately be related to this objective. However, as in private business, there are many objectives which are the immediate cause for a particular action, each with its own relation to the service motive. The following outline, based upon particular study of the operating policies actually followed in recent years by Detroit, Denver, East Bay, and San Francisco water utilities, indicates the nature of these subobjectives as well as the policies handed down to the operating executives from the trusteeship committee and the co-ordination executive evolved out of these objectives.

Desire to provide for future enormous population growth.—Such belief was general among water-utility executives until the recent depression plus the new knowledge of declining net birth-rates began to take effect. It has resulted in water-utility construction of large overcapacity in terms of present consumption rates in new lake intakes, new river water supplies obtained by means of long aqueducts, new and enlarged pumping stations, and laying of large trunk mains, especially into suburban areas.

Desire to develop and maintain good public relations.—This has resulted in reducing water rates to protesting classes of customers; reducing taxes instead of water rates in some cases where tax levy is part of the water-utility income; eliminating harmless tastes and odors, even at large expense; eliminating poor pressure districts; liberalizing the main extension policy; assuming responsibility for the "service pipe" under the pavement; paying banks and stores to act as neighborhood collection agencies; sending collectors to the homes of customers as a monthly courtesy routine; offering a discount for prompt payment instead of a penalty for delay; treating delinquents, including charity cases, courteously; using the power to shut off water only as a last resort; establishing a central complaint division; encouraging public visiting of places of interest owned by the water utility and providing park and recreational facilities at such places; using literature distributed with bills, as well as movies and advertisements for good-will purposes; training employees in courtesy and service; purchasing all possible supplies through local concerns; distributing purchases by rotation or by lot among equally available dealers; purchasing insurance through the local association for allotment to all alike; avoiding force-account "competition" with local business houses capable of rendering the service desired; obtaining and making public an annual certified public-accounting audit; and submitting the proposed annual budget to such an agency as the local chamber of commerce before adoption.

Desire to get along with the municipal government.—This has resulted in failing to collect for water service rendered to the city government; co-operating in emergency relief projects, though this diverted available water-utility funds toward secondary rather than primary construction needs; avoiding an open issue with the health authorities over the right to turn off water in occupied premises in order to force payment of delinquent bills; improving the fire protection offered by the water system; assuming redemption and interest cost on long-time debt of the water utility; rendering of many petty services to various branches of the city government, usually without charge; collecting a sewage-disposal charge by inclusion on the water bill;

assuming the cost and obligation of operation of the sewage-disposal plant for the city.

Desire to provide steady employment and good employee relations.—This has resulted in transferring displaced employees to a "labor pool" for reassignment, the labor pool being given some work each month; providing "fill-in" work for repair and maintenance forces to permit employment on full time; providing liberal plans for compensation in event of accident, illness, old age, or death; continuing employment of "working" pensioners where no pension plan exists; developing classifications of salary grades; providing for more or less automatic service promotions; recognizing seniority rights in promotion and layoff; encouraging employee organization for collective bargaining, credit union, and other purposes.

Desire to improve operating conditions.—This has resulted in replacing short-lived by much more durable materials in structures and equipment; systematic planning of the proper size of pipe to lay in a particular street in terms of the future gridiron; constructing duplicate facilities at keypoints for stand-by protection; providing complete, detailed system drawings for all employees required to do emergency work; systematic following-up of fires, and systematic checking of street valves and fire hydrants; eliminating all unprotected cross-connections with other water supply; providing strict laboratory control of water purification; chlorinating newly laid mains before they go into service; providing twenty-four-hour emergency service for main break repairs.

Desire for economy—This has resulted in substituting power operation for hand operation of large valves; planning maintenance of structures and equipment rather than scattered repairs; attempting to reduce the accident cost incident to operation and construction; holding material sellers and contractors to the performance and results guaranteed by them or demanded in the specifications; constant inspection and maintenance of meters to keep them registering the highest possible percentage of water passed through them; sorting and sale of salvage; study of materials to obtain the best possible combination of first cost, instal-

lation cost, and maintenance cost; methodical water-leakage surveys and methodical cleaning of mains, to reduce pumping and filtration costs; use of mechanized billing and accounting procedures; design of rate structures and customer rules for minimum office cost.

This summary is noteworthy for its slight emphasis upon selling. In fact, almost no water utility makes any effort to sell its services at all. It is taken for granted that he who wants water service will come to the office and demand it.

The general service objective is motivated by much more than the desire for operating economy. The economy motive is far less effective in causing actual action than almost any other subobjective. This is not because the water utility does not desire economy, but because the problem usually appears before the water board and its executives with some other phase commanding the major emphasis. The tendency is to submerge the economy motive under the argument of "paramount necessity" for population growth, good will, or some other reason. Economy has few champions before the board other than the operating executives, and they often are unwilling to experiment, desiring to leave well enough alone.

The theory, based upon admittedly limited observation, is hazarded that the less stable and less effective the trusteeship committee, the farther down within the operating organization tends to be concealed the true responsibility for polity. By this is meant that the operating executives, trying to work under an unstable board, tend to avoid and evade carrying problems up to the water board for solution. In a large organization there is usually sufficient precedent for an action to make its repetition possible without its becoming an issue of importance to the management committee. This puts the unstable management committee in a curious and ineffective position. On the one hand, it orders that all details of some specific character come before it. For example, in Denver some years ago, every application for water service "outside the city limits" had to be brought before the management committee. Thus it swamped itself with those details that were the subject of its order. On the other hand, by

adroit reference to precedent, operating executives increased their actual responsibility for policy and action in fields not the subject of interest of the management committee, but did so at the expense of progress, since precedent provides no basis for advance.

THE PROBLEM OF REORGANIZATION

When a new machine is installed—for example, a new electric pump—the entire operating force of the water utility, executives and employees alike, understand that the old steam pump it has replaced was junked because it was obsolete. There is no feeling of resentment or any desire to protect the new electric pump from ultimate replacement for similar reasons of further improvement at some future date. This general statement remains true even though the new electric pump can be operated by one employee per shift, no longer requiring both an engineer and a fireman.

On the other hand, when a new method of organization such as a new office system is installed, executives and employees do not always understand that this came about because the system in use was obsolete and deserved to be replaced. There is sometimes the keenest kind of resentment, even though, as was true in Denver in a recent case, the immediate effect of the new installation was to increase employment.

This situation may be paralleled in other fields. The public, for example, objects strenuously and effectively against the use of enforcement methods of reasonable and sensible character to bring about reduction in water waste by deliberate and irresponsible wasters. On the other hand, there is far less resentment against installation of meters, which accomplish the same result even more directly.

Thus there are two very different fields of reorganization activity within the water utility: that in which reorganization is brought about chiefly through installation of machinery or other construction and that in which reorganization is largely a matter of retraining and reassigning personnel. The one field, of course, shades into the other. The length to which the physical type of reorganization has been carried in recent years in water utilities is suggested in the following:

1. Water utilities in the larger cities are reorganizing their physical plant on the assumption of perpetual operation. Thus, according to Spurr, small water utilities in boom towns have been allowed depreciation rates recovering the entire capital out of rates in twenty to twenty-five years.[15] On the other hand, the two largest private companies, typical of the larger municipal water utilities also, were assigned depreciation rates on depreciable property equivalent to ninety-three years, the estimated average life for the Indianapolis Water Company, and ninety-one years, the average life for the Hackensack Water Company's property.[16] Obviously these long-life rates are made possible only by use of the most durable construction, plus maintenance at the highest possible percentage condition.

2. Reorganization of physical plant for maximum fire-prevention effectiveness has also progressed far toward its goal. Thus the Los Angeles water utility, from date of purchase in 1902, has increased its mileage of pipe 4 inches in diameter or less,[17] of little value in fire protection or water circulation, from 240 miles to 1,100 miles.[18] It increased its mileage of larger pipe, useful in fire protection and water circulation from 60 miles to 2,700 miles. Detroit's water system started in 1824 with wooden pipes.[19] By 1930 the water utility reported 2,757 miles of permanent pipe, less than 20 miles being of the 4-inch size unusable for fire protection.[20] In the smaller metropolitan water utility of Erie (in 1933), out of 250 miles of distribution system, 225 miles were 6 inches or larger, effective for fire protection.

3. Similar reorganization of the physical equipment of pumping

[15] H. C. Spurr, *Guiding Principles of Public Service Regulation* (Washington, D.C.: Public Utilities Reports, Inc., Munsey Bldg., 1924), II, 488–95.

[16] *Ibid.*

[17] Anon., *A Tale of Two Water Plants* (Denver: Denver Union Water Co., 1909), pp. 1–3.

[18] Board of Water and Power Commissioners, *Annual Report* (Los Angeles: Board of Water and Power Commissioners, August, 1933), pp. 50–53.

[19] G. H. Fenkell, *A Descriptive Survey* (Detroit: Board of Water Commissioners, October, 1928), p. 8.

[20] Board of Water Commissioners, *Annual Report* (Detroit: Water Department, 1930), pp. 67–69.

plants has also taken place. Thus in 1919 Erie water-utility cost of coal for pumping a million gallons of water was $8.43. Still using steam power, Erie was able to show a cost for coal of $3.94 per million gallons pumped in 1933.[21] In Denver the cost in 1919, 1920, and 1921, using coal, was about $22 per million gallons pumped, the cost including all maintenance and operation. Using gas and electricity, the Denver cost in 1933, 1934, and 1935 has averaged about $15 per million gallons pumped.[22]

Similar reorganization where it is not possible to throw the burden upon capital additions or replacements has not made such rapid progress. Some of the reasons for this lag are:

1. Physical improvements are commonly planned and originated by the operating executives. If approved by the top executive and the trusteeship committee, they are pressed vigorously by the operating executives, who take great pride in keeping plant and equipment in the front rank. Changes in human conditions, on the other hand, are commonly originated by the trusteeship committee or the top executive, and are handed down from above.

2. In private business reorganization can and does cope with unco-operative or obstructionist executives or employees by dispensing with their services. In the municipal water utility civil service hampers such action. As a result reorganization may have to fight its way inch by inch against the outspoken resistance of executives or employees. The new system or plan of organization may have to be intrusted to its own violent enemies, namely, the employees and executives displaced by the change. Politicians do not hesitate to step in to organize this resistance for their own ends. The public sides with the employees, perhaps taking the position that reorganization is a kind of punishment, to be barred from "model" municipal employment.

An example of a reorganization problem involving the water-utility personnel rather than its capital is presented as the *Annual Report* for 1933 of the Cicero water utility. This community, for

[21] Commissioners of Water Works, *Annual Report* (Erie, Pa.: Commissioners of Water Works, 1933), pp. 40, 46.

[22] Water Department, *Annual Operating Report* (Denver: Board of Water Commissioners, 1935), p. 50.

years, had indulged in three improper operating practices. Meter readers had been permitted to report as the amount of water used, the minimum bill equivalent in water. As a result, meter-readers in many cases did not read the meters at all; in others, perhaps deliberately misread them in order to report the minimum bill. The second defective operating practice consisted in leaving a meter in service, without repair, even though it had entirely ceased to register the passage of water. The third defective operating practice consisted in faulty maintenance of the poorly constructed pipe system, thus permitting excessive system leakage.

Accumulating for years, these practices finally produced an intolerable situation in the form of excessive deficit between what Cicero, a suburb, was paying Chicago for water plus its water-utility expenses, and what the citizens of Cicero were paying for the water service. This finally forced the trusteeship committee, the city council, into action. A new executive was employed to head the water utility. A survey made by accountants showed where the trouble was. Cicero, with a deficit of $35,000 in 1931, was paying Chicago the sum of $78,000 for water which disappeared in the Cicero system, not paid for by Cicero citizens.

A firm of consulting engineers was then employed to find the leaks. They found one hundred and thirty-three such leaks under the streets, wasting nearly two million gallons per day. The saving this represented in water purchased from Chicago paid the cost of the leak survey in forty-two days.

The meter-readers went to work reading the actual figures of water consumption shown by the meters. One-third of the meters, found out of order, were repaired and placed back in service. Customers complaining about high bills were forced to repair leakage on their own premises before excessive back charges, accumulated during the period of defective meter-reading, were compromised. As a result, in the words of the report itself:

> In 1933 the water purchases decreased nearly $12,000 over the previous year. . . . . Water billings, on the other hand, increased $30,000. . . . . Approximately 50,000,000 cubic feet of water which previously had not been accounted for was registered through meters in 1933.[23]

[23] F. J. Broz, *Annual Report* (Cicero Ill.: Bureau of Water, 1933), pp. 23–25.

It seems incredible that any business, even a small municipal water utility, should have to reach such a defective operation level before effective support could be found for the money-saving and common-sense reorganization described. It emphasizes the relatively greater difficulties faced in reorganization of the human side of the water utility than the physical side.

Denver offers an illustration of similar character encountered in reorganization of its system of making the seventy thousand flat rate bills sent out to its customers quarterly. There was, of course, no emergency to force action as was true in Cicero. There were, however, several careful reports of experts pointing out to the trusteeship committee the defects in the existing system of billing and the advantages of improvement. These finally provided the incentive for action.

The predecessor private water utility was purchased by the city in 1918. Beginning with 1910, however, its private owners were faced with the certainty of ultimate municipalization, the public having refused to renew the franchise in that year. The municipal water utility, therefore, inherited a billing system, installed before 1910, that was already beginning to be regarded as deficient and unprogressive. This system of pen-written bills, based upon the skill and integrity of the bill-writer, who also posted and corrected the master billing record and created and posted the customer adjustments, continued in use with little change down to 1934.

Not only was the method of creating the bills obsolete in 1933, but also the basing method of flat-rate billing was obsolete. Denver is one of the few large cities in the United States that has taken no real steps toward installation of meters and measurement of water used as the basis of the bill. The flat-rate billing base is obsolete because it is not possible, by house-to-house inspection of fixtures in use, to create as accurate a record as that furnished by the meter; because the assembly of flat rates for this and that fixture is more arbitrary in its final charge than is a charge based on the record of water used; because customer adjustments are a matter of inevitable dispute, not capable of solution by reference to an exact meter record; and because the flat-

rate system uses more labor and less machinery in the inspection and office system and therefore is inherently more costly. No attempt has been made to improve the customer's bill and reduce the cost by moving toward universal metering. The less important problem of reorganization of an obsolete billing system was finally accomplished.

Each step of this comparatively minor problem in reorganization involved a battle of some sort. For example, experts had pointed out the folly of sending out nearly seventy thousand bills at the same time four times a year, thus creating an enormous peak in collections and billing activity, followed by a two months' interval to the next peak. It was decided to change the billing, so that one-third of the city would be billed each month. This was done; it at once met with opposition from the real estate owner, large and small, who owned property in different parts of the city. It had been a convenience to him to receive all his water bills at the same time for all parts of the city. It increased his bookkeeping to have to pay water bills in one part of the city in one month, in another part the next month, etc. As a result of this opposition the water board refused to change the technical billing dates, so that the system of staggered billing, as installed, attempted to collect from one-third of the city one month in advance of the technical billing date for the particular quarter; the next third received their bills as they are accustomed; the final zone of the city was billed one month late. The natural result has been that at first over half, and gradually lesser, percentages of the owners billed one month in advance refused to pay until the actual billing date, requiring extra work in sending out a second followup bill.

Ultimately the public may be expected to forget the implications of the technical billing date and accept the new rotation system. By that time the water board might well refuse to incur the expense of adjusting the billing date to the facts by adjusting one quarter's bills by hand, subtracting a month's charges from the prebilled zone and adding one month's charges to the postbilled zone. It is reasonable to suppose that compromises of this sort, required in order to get something done, are the origin of

many of the curious inconsistencies in the practices of publicly owned and managed enterprises.

For over a year the attempt was made to bill by means of the usual electric billing machine, which is posted by hand with the variable billing data and which then creates the bill, printing the totals at various points and adding the nonvariable data such as the date and type of bill. This installation got a bad start with the employees of the billing and accounting division. They fought it bitterly and successfully even to the point of more or less open sabotage. The chief gain of this prolonged battle was acceptance of the idea of a new billing system as inevitable. Among the employees, even the staunch supporters of the system of hand billing gradually admitted that return to it was improbable if not impossible.

At the beginning of the following year the operating executives of the accounting and billing division, with the full knowledge of the interested employees, expressed their preference for experimental installation of a particular type of punched-card billing equipment. During the succeeding year this equipment was installed, employees were retrained in the new routines, and billing became successful. Among the incidental gains of the new punch-card system of billing of interest from a management standpoint are the following:

1. Some years before, in order to save billing time and cost, and in order to reduce customer disputes, the water utility had abandoned itemization of the customer bill, thus converting the groups of fixture rates at each premises into a customary lump sum, paid year after year as long as it remained unchanged, without protest. The new punch-card bill, once the card had been properly prepared, placed on the individual bill, in addition to the total and the current adjustments of arrears and prepayments, the more important details concerning the fixture rates themselves. This resulted in much improvement in the bills, through customers coming in to protest against inclusion of improper items on their bills. There has been an important increase in customer good will.

2. Guaranteed accuracy of billing, provided the punch-card

machine has been given accurate facts, brings into focus the real heart of the problem of flat-rate billing, namely, proper establishment of the facts through inspection of premises, proper translation of these facts into the individual rates for billing purposes, and accurate transfer of these results to the punch-card record. The rate, theoretically for use of water, charged against an automobile kept on the premises of two dollars per year, or fifty cents per quarter, illustrates the problem. When an inspector finds an automobile is kept on the premises, he reports the fact. Assuming that it reaches the billing record properly, the practice is not to remove such a charge even though the inspector, on subsequent trips to the same premises, does not happen to report an automobile there. To get the automobile charge off it is necessary for the inspector to make a positive finding that no automobile is being kept there. This procedure clearly is necessary because of the movable character of the automobile.

The real gain from the new system of billing and related improvements has been in control, which is here used in the accounting sense. The C.P.A. audit of the Denver water utility for 1934 and 1935, the first real audit of this type in its municipal history, reviewed this question in the following words:

> The new duties and services performed . . . . are all important, and while each one has added to the cost, the additional cost is fully justified. By far the greater part of the increased cost, in fact almost all of it, should be charged to the cost of obtaining and maintaining administrative controls which did not previously exist. Too much importance can not be attached to this factor. The lack of proper controls leads to errors in billing and collection and creates a condition in the office which contributes to carelessness, arbitrary treatment of consumers, and, in fact, actual dishonesty.[24]

Experts studying the former hand-billing system believed that substantial reduction in cost could be obtained. This financial saving has not been realized. As in many other phases of reorganization, there are other management aspects than direct money-saving. By dividing all office costs except general administration and engineering by the number of bills produced, the C.P.A. auditors came to the conclusion that, under hand billing and hand

[24] C. W. Collins, *Report on System and Methods* (Denver: Clem W. Collins & Co., March, 1936), p. 45.

accounting, the cost per consumer billed had averaged about $1.66 per year. Under punched-card billing and machine accounting, the new conditions, the cost per consumer billed, at its maximum point immediately after installation of the new system and before time had evolved all the cost advantages, will be, in 1936, $1.84 per year. This amounts to the difference, in this particular Denver case, between 5 and 5.5 per cent of annual income expended on office costs.[25]

In the Denver water utility, from 1933 to 1936, almost every phase of human organization and system was reorganized, with, generally speaking, similar disappointing results from the standpoint of large savings in dollars. While individual pay was changed around and individual responsibilities were reorganized, no one was fired; no new blood was brought in; and no methodical study of individual duties by means of time study or in any other manner was attempted. What happened to the savings made by reorganization, so that they did not appear on the surface, is indicated as follows:

1. Reduction in the average working-week for all employees from an average of forty-four hours to an average of about forty hours, or about 10 per cent, was only partly offset by pay reductions. Since much utility work consists of machine and position tending, there has probably been little gain in efficiency by the shortened hours.

2. A large number of "merit" increases in pay were made. In addition, all long-service employees were placed on the monthly pay roll, thus giving three hundred and fifty instead of two hundred and fifty annual vacations with pay.

3. A formal sick-leave plan was put into effect, costing about 1 per cent of pay roll each year.

4. Much new work, such as the new accounting controls, was undertaken. For example, the fourteen thousand street valves are now being tested about annually by a group of regular employees.

THE SPREAD OF CRITERIA-MINDEDNESS

The importance of the so-called planning movement to the operating executives of the water utility lies in the spread of

[25] *Ibid.*, pp. 43–47.

criteria-mindedness. Criteria, in so far as they can apply to water-utility operation, are merely formulations of the basic objective of rendering a satisfactory service to a certain group of citizen-customers. Criteria differ chiefly in the particular bias of the formulator. Thus there are criteria from the federal public health point of view and from the point of view of national "social responsibility." At the opposite extreme there are criteria of internal balance, formulated by the operating executives themselves and written into the operating budget, or formulated by the water board and written into the customer rules.

Criteria play an important part in smoothing the way for system reorganization. A criterion has much the same effect as installation of a new machine. It has already been pointed out that operating executives and employees have accepted with comparative good grace substitution of electric pumping for steam pumping, cutting employment in half and imposing the necessity of learning a new operation routine upon the surviving employees. Similarly, the federal public health criteria concerning cross-connections with other unprotected water supply and concerning the potability control of the municipal water supply have been almost universally accepted and enforced by operating executives and employees, even though they result in conflict with powerful customers and necessary development of higher personal skill and care in operation. It cannot be argued that the federal government has achieved this by dint of higher authority, the only lever available to it being approval or disapproval of the particular water supply for use in passenger cars of interstate railways. Local pride, motivating water boards, top executives and operating executives alike, has been the real force. Here was a reasonable criterion, precisely formulated, capable of attainment by improvement not of plant but of system, that was attained with little internal opposition.

Some of the criteria, now generally accepted by water utilities or likely soon to be accepted, are as follows:

Criteria of social responsibility.—The basic criterion, as suggested by Black, is that every house must be equipped with hot

and cold running water and have a private inside toilet.[26] It follows that water utilities must abandon the present practice of turning off water for nonpayment of bills, or at least must modify the practice. Other agencies of the city government must face the problem of providing living units not so equipped with such facilities.

During this last depression this has been a live issue with metropolitan water utilities, forced to acquiesce in the social responsibility point of view by delaying turnoff of thousands of delinquent customers for months. In some cities health authorities have insisted that no house containing a water closet be deprived of water service as long as it was occupied. Experiments have begun with partial turnoff in such cases, thus depriving occupants only of the luxury uses of water.

Water utilities must soon face the fact that their monopoly of portable water supply carries as its natural converse the responsibility of furnishing water for the necessities of life to all without charge or taint of charity. Something akin to the free public fountain or town pump is reappearing. Thus the Manila Metropolitan Water District, a modern American water utility, has continued the age-old practice of providing free water for the poor at public hydrants.[27] It is probable that water utilities will soon realize that the practice has merely been temporarily interrupted in this country.

Criteria of maximum efficiency in fire protection.—The National Board of Fire Underwriters has been very successful in bringing about great improvements in construction and in operation of water utilities in larger metropolitan cities, with the end in view of maximum fire protection. This has been done through preparation of a detailed engineering study of each system, which, with recommendations, is then printed and made available to the officials and executives of the water utility. This report forms the basis, in part, for the determination of basic fire insurance rates

[26] R. V. Black, *Criteria and Planning for Public Works* (Washington, D.C.: U.S. Public Works Administration, June, 1934), chap. x.

[27] M. Villalobos, *Annual Report* (Manila, P.I.: Metropolitan Water District, 1932), pp. 6, 7.

for the particular city and for its subdivisions, especially as between commercial and residential districts. Its commendations and recommendations are taken very seriously, especially by operating executives, who press every opportunity to persuade the trusteeship board and top executive to take further steps suggested by the report.

Good operating practice, according to the fire underwriters, may be summed up as follows: There must be stability of management and of working force. Routine engineering records must be up to date and complete. Water-utility employees must respond to fires and aid in operating values and hydrants. Hydrants and valves must be well maintained, and must, under careful sample tests, show performance capable of meeting estimated fire hazard in the particular part of the city. There must be ample water supply close to the city. Pumping stations must be well located, and capable of operation under conditions of partial breakdown. Water pressure must not fluctuate below the minimum required for successful operation of automatic sprinklers. The distribution system must be well arranged for transportation of large volumes of water to the points where it will be needed in case of fire. Customers must be metered, so that their wastefulness will not deprive the water system of its excess capacity needed for fire-extinguishing purposes.[28]

Criteria of "scientific" meter-rates construction.—The work of the New England Water Works Association and of various experts has developed among operating executives the goal of a scientific meter-rate structure toward which to plan and to work. Thus the New England Water Works Association some years ago recommended a two-part rate, consisting of a service charge separate from the charge for water measured through the meter. This service charge was to cover the cost of the meter and service, plus one dollar per year for reading and billing, plus a variable charge for unregistered water leaking through the meter.[29]

[28] National Board Engineers, *Report on the City of Denver, Colorado* (New York: National Board of Fire Underwriters, 85 John St., February, 1928 [superseding 1910 and 1921 reports]), pp. 1–40.

[29] Allen Hazen (chairman), *Final Report of Committee on Meter Rates* (Boston: New England Water Works Association, February, 1916), pp. 3–7.

Where the opportunity to revise the meter rate has been presented, operating executives and top executives have worked long to try to develop an "ideal" or "scientific" meter rate for their cities. The influence of the New England proposal may be seen in the actual rate structures of many American cities.

Criteria of the operating budget.—Formulation of an operating budget and its acceptance by the trusteeship committee have an enormous effect upon the operating executive. His minor construction or system projects, pet ideas and necessities, acquire new status when they appear in his "allowed" budget. If the budget appeals to him as fair he will spend long hours at cutting and fitting it mentally to permit accomplishment of all he wants to do, without overrun. If the budget seems unfair, he will spend equally long hours trying to circumvent it, either by finding some additional funds or, as a last resort, by honest economy. Most budgets, from the standpoint of the particular operating superintendent, are a mixture of both fairness and injustice to his department or subdepartment.

The operating budget, like most criteria, has drawbacks if carried to an extreme. Inflexibility, for example, brings its own reward in work not properly done. The budget does not entirely solve the age-old problem of overemphasis because of a good salesman executive in one division or department and underemphasis in another. The budget contains nothing to indicate whether a particular part of the business could be operated more economically; in fact, without much outside study, the budget may freeze the existing way of doing things and the existing allocation of the total operating allowance between divisions. With all its defects, however, the budget does provide the trustees, the top executive, and the operating executives with a yardstick by means of which to measure relative progress in the course of the year. Water utilities think, through their executives, in terms of broad criteria or formulations of phases of their basic objective of service. The budget performs a similar purpose of stating the limits of expenditure for accomplishment of this service goal, and of showing each operating executive what his limits of expenditure are, if he is to fit himself into the total allowance.

The new criterion of "optimum" balance.—Closely related to the operating budget is the new criterion of optimum balance of income, operation and maintenance expense, development of plant and equipment, and population growth and shift. During the era of rapid population growth and rapid evolution of water-supply inventions, now drawing to a close, all that water-utility executives could do was to concentrate on the major problems of catching up with growth. Now that population growth is clearly slowing down, especially in the heart of the metropolitan center where the central city water utility chiefly operates, it is possible for the more mature point of view of optimum balance to develop. It no longer seems likely that water-utility executives of the next generation will have to contrive to expand their water systems fast enough to meet such forecasts as were made seriously a few years ago, predicting 7,000,000 for the Philadelphia Metropolitan Region by 1990; 2,256,000 for the Washington Region in 1980; Denver, 1,000,000, and the East Bay Region, 2,000,000—both by the year 2000; or Los Angeles 8,000,000 by 1960.[30]

One of the most difficult problems to which to apply the criterion of optimum balance is with respect to building in over-capacity. Thus Erie built its first substantial lake intake in 1896. This conduit in 1933 was reported to have a maximum capacity of 36,000,000 gallons a day, compared with average daily consumption of 20,000,000 gallons. In 1932 a second intake was constructed, adding its maximum capacity of 70,000,000 million gallons a day. Thus Erie has given itself the safety factor of two separate intakes, with a combined capacity of five times the present daily consumption. Doubtless Erie was justified in this

[30] Regional Planning Federation, *Population Trends* (Philadelphia: Regional Planning Federation of the Philadelphia Tri-state District, December, 1930), p. 4; Washington Region Water Supply Committee, *Reports and Plans, Washington Region* (Washington, D.C.: National Capitol Park and Planning Commission, 1930), p. 89; H. S. Crocker (chairman), *Report of Engineering Board of Review to Board of Water Commissioners* (Denver: Engineering Board of Review, 1922), pp. 15, 16; East Bay Municipal Utility District, *The Story of Water* (Oakland, Calif.: East Bay Municipal Utility District, 1931), p. 29; T. Merriman, *Letter from T. Merriman—to W. P. Whitsell—in Regard to the Water Requirements* (Los Angeles: Metropolitan Water District, July, 1931), p. 6.

expenditure, for example, in greater ability to choose water of good quality. It merely illustrates the problem facing the operating executive at every turn in every part of the water system. Generally speaking, it has been the practice of municipal water-utility executives to build in far more overcapacity than was characteristic of private predecessor companies. This added factor of safety has been justified as necessary because of the rapid increases in population and great shifts of population out toward the suburbs. With slower population change extreme overcapacity in particular structures may well prove to be an expensive monument to municipal overconfidence.[31]

Another difficult problem to which the criteria of balance must be applied is that of the ultimate relationship of suburbs and central city. This problem must be solved by the trusteeship committees and the top executive, but, of course, with the co-operation of the operating executives. If we may say with confidence that the typical water-utility trusteeship committee has periods of instability, it is even more true to say that the relations between two such committees, one representing the central city water utility which has by huge expenditures assured itself an ample water supply and the other representing the suburb, anxious to grow and resentful of interference, are more often strained than happy. The reasoning of the criterion of balance works strongly toward a solution. If the central city water utility has the capacity to serve the suburb, capacity unlikely to be used within the central city, it is obviously an unbalanced situation to deal harshly with the suburb and encourage or force competitive development of a duplicate water system. The political motive of using water shortage to force annexation petitions is gradually giving way before the more logical motive of construction of a metropolitan water system. Thus Baltimore, required by state law to provide water supply for suburban pipe systems, now, as a matter of operating routine, prescribes main sizes and routes both inside and outside the city limits, to the end of developing the metropolitan distribution system in balanced fashion.

[31] Commissioners of Water Works, *op. cit.*, pp. 66, 68.

SUMMARY

This discussion of management of the municipal water utility at the operation level has considered the organization of departmentation. The point has been made that functional organization seems almost universal, except at the lowest subdepartmental levels, where territorial departmentation is the common rule, in order to provide for unified responsibility for scattered centers of operation. There is a rather clear-cut line of demarcation between the functions reserved for direct contact with the trusteeship committee and the functions commonly placed under the top executive of the water utility, of operating character.

The main objective of the municipal water utility is to render satisfactory water service. This main objective may be restated in detail as expressing itself in different types of motivation of policies, such as desire to provide for future enormous population growth, desire for good public relations, desire to get along with the municipal government, desire for good employee relations, desire to improve operating conditions, and desire for economy. This main objective may also be reformulated, viewed from various standpoints, such as the public health criterion, the social-responsibility criterion, the fire-protection criterion, the scientific criterion, the criterion of the operating budget, and the criterion of optimum balance.

Under conditions of instability of the trusteeship, committee policies are not persevered in, and delegation of authority is restricted and of temporary character. It is believed that the less stable the trusteeship committee the farther down into the operating organization tends to be concealed the responsibility for policy.

Reorganization brings into its true light the relatively large responsibility for policy exercised by operating executives and even by employees. Operating executives have, in general, favored replacement of obsolete equipment, but have developed very slowly a similar attitude toward obsolete systems and methods. Development of detailed formulations of the service objective as "criteria" has been an important factor in stimulating operating executives and employees toward replacement of obsolete method and system.

THE USE OF SIMULTANEOUS EQUATIONS IN BUSINESS PROBLEMS

JOHN H. SMITH[1]

A PROBLEM in interlocking departmental charges in cost accounting led to the study on which this article is based. The solution presented in the text consisted of successive distributions, and the process was carried out until the required accuracy was attained. Since the problem is presented in detail later, it may be stated briefly here that the limit of the process was evaluated. This limit proved to be a simple formula which could be used in finding answers to similar problems. This solution was fairly satisfactory, so an attempt was made to derive a similar formula for more than two departments rather than to search for an entirely different method of solving the problem. The solution was extended to three departments by the process of summing infinite series but, since the work involved in further extension would be very great, the solution for each of the unknowns was examined more closely. These were in fractional form and the numerators and denominators appeared to be the expansions of determinants such as might arise in the solution of simultaneous equations, but a different constant factor appeared in each numerator. When each unknown was divided by the corresponding factor, a system of linear equations in the new unknowns could be set up from the determinants. With these equations before him, the writer suddenly realized that if he had studied the problem carefully and stated the conditions in mathematical form he could have stated these equations directly from the conditions of the problem.

It is interesting to analyze some of the conditions which might cause a person who is familiar with simultaneous equations to fail to recognize the problem as one in which a system of linear equations might be useful. Besides the misleading nature of the solution in the text, one might include in such a list lack of familiarity

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with the problem and failure to state the conditions in the form of equations. If the conditions of the problem had been set up in equation form a better choice of unknowns could have been made. In terms of symbols to be introduced later, the linear relationships among the X_i's are simple, while linear relationships among the C_i's are much harder to derive.

Problems similar to the one described above are not confined to cost accounting. They may arise in any field of business. Thus it seems especially important that a treatment of simultaneous equations should be included in textbooks in business mathematics.

The relationships between variables in many business problems are often more easily stated when a particular choice of unknowns is made. This implies that more attention should be given to the analysis of problems and the statement of the verbal conditions in the form of simple equations. Less emphasis should be placed on minimizing the number of equations expressing these conditions, since a relatively large number of simple equations can easily be combined into a smaller number of a more complex nature. In this connection it may be noted that many problems leading to equations in one unknown have two conditions which might be stated as equations in two unknowns. An example, as follows, will make this point clear:

John and Mary have 30 cents ($x + y = 30$).
Mary has twice as much as John ($y = 2x$).

The statement of this problem in one unknown really involves solving the second equation mentally and substituting in the first. In such simple problems this is not important, but it would be apparent if the relationships were more complex. These points will be illustrated in the income tax bonus problem given below, although the importance of an appropriate choice of variables would be greater if there were a greater number of unknowns.

There are some rather striking examples of problems which illustrate the usefulness of simultaneous equations. For instance:

A corporation has $98,000 which is available for paying dividends except for a 10 per cent income tax and a bonus to the president of 20 per cent of the

profits after income tax is paid. How much bonus money will the president receive?

To a student who has not had training in analyzing problems with a view to stating them in manageable mathematical symbols, the problem presents difficulties since it is obvious that income tax will not be paid on the amount of the bonus nor will the president receive 20 per cent of the money paid for taxes. Although the unknowns are obviously interdependent, the relations between them are not sufficiently simple and the problem seems to be insoluble by elementary methods.

A set of suggestive symbols is helpful in the analysis of a problem of this type. Such a set is given below, together with the values of each in this problem if it is known.

Let

A = Total amount ($98,000)
A_t = Amount on which tax is based
A_b = Amount on which bonus is based
B = Amount of bonus.
b = Bonus rate (0.20)
T = Amount of tax
t = Tax rate (0.10)

A student might try to solve the problem by formulating a set of two linear equations involving only B and T and known quantities. Such attempts usually fail, not because such equations cannot be written but because the reasoning leading to the required relationships is complex. Sets of equations involving only B and T or A_b and A_t can be written directly from the conditions of the problem by persons who have become adept at translating verbal problems into mathematical terms. Feats of this kind should not be expected of beginners, however. A beginner should first state the conditions of the problem in symbolic form and then combine the list of equations into a shorter list before proceeding with the solution. The set of conditions for the problem at hand may be stated as follows:

$$A - T = A_b, \tag{1}$$

$$A - B = A_t, \tag{2}$$

$$T = tA_t, \tag{3}$$

$$B = bA_b. \tag{4}$$

As has been previously suggested, a set of equations involving either of two pairs of unknowns can be obtained by substituting from equations (3) and (4) in equations (1) and (2). Retaining symbols, the simplest set in terms of A_b and A_t is

$$A_b + tA_t = A\,, \tag{5}$$

$$bA_b + A_t = A\,. \tag{6}$$

Multiplying equation (5) by b and subtracting the result from equation (6),

$$A_t - btA_t = A - bA\,. \tag{7}$$

Solving (7) for A_t,

$$(1 - bt)A_t = A(1 - b)\,, \tag{8}$$

$$A_t = A\,\frac{1-b}{1-bt} = \$98{,}000\,\frac{0.80}{0.98} = \$80{,}000\,. \tag{9}$$

Similarly, multiplying equation (6) by t, subtracting the result from equation (5) and solving for A_b,

$$A_b = A\,\frac{1-t}{1-bt} = \$98{,}000\,\frac{0.90}{0.98} = \$90{,}000\,. \tag{10}$$

Substituting from (9) and (10) in (3) and (4),

$$T = \$80{,}000t = \$80{,}000 \times 0.10 = \$8{,}000 \text{ amount of tax}\,, \tag{11}$$

$$B = \$90{,}000b = \$90{,}000 \times 0.20 = \$18{,}000 \text{ amount of bonus}\,. \tag{12}$$

In the remaining problems the steps in the solutions will not be given in detail, but it is helpful to write out all of the conditions of any problem if the method of solution is not readily apparent.

Two recent texts for courses in business mathematics will now be examined as examples of the type of texts now appearing on the market which could be improved by the inclusion of some of the materials suggested in this paper: *Practical Business Mathematics*, by Justin H. Moore and Julio A. Mira (Longmans, Green

& Co., 1938; pp. 229, $1.00); and *Business Mathematics, an Introductory Textbook*, by J. Donald Watson (New York: Ronald Press Co., 1937, pp. 260, $2.50).

Moore and Mira have presented the topics covered in their book in a clear and interesting manner. Discussions of the usefulness of each topic are combined with a brief but well-balanced theoretical development and concise rules for the application of principles in the solution of problems.

These topics include the fundamental operations of arithmetic, use of formulas, simple equations in one unknown, ratio and proportion, percentage, logarithms, denominate numbers, interest, discounts, present worth, annuities, depreciation, and probability. In a book covering such a broad range of topics some of the explanations must be brief, and in a few cases they are inadequate. One wonders why some of the more technical chapters were not omitted in favor of a more complete treatment of other topics.

Watson's text includes a greater range of topics and therefore the developments are even more condensed than those of Moore and Mira. The range of topics includes interest, discount, foreign exchange, statistics, accounting, annuities, depreciation, insurance, and logarithms. This text presents a great many types of problems and is well adapted for students who have had courses in mathematics and who need to develop an appreciation of the wide range of problems which must be solved in business. Considering the scope of topics, the author does very well, indeed, with his explanations; but when, for example, a writer devotes twenty-one pages to a discussion of statistics in which he discusses collection of data, frequency distributions, progressive, periodic, and moving averages, seasonal variation, graphic presentation, and index numbers, the extreme degree of condensation becomes objectionable from the point of view of a student trying to learn mathematical principles which he can apply to the solution of problems in business.

Neither of these texts deals with simultaneous equations, although both discuss topics which are more difficult from a mathematical point of view and which are of a more specialized nature. Both give rather extended treatment to topics from mathematics

of finance. Watson's chapter on statistics has already been mentioned. It seems to the writer that textbooks in business mathematics should emphasize the mastery of mathematical principles which are capable of wide general application, even if students must be referred to other texts for material which is particularly useful in special fields, especially if excellent texts are available in such fields.

The following problem, taken with minor changes from a textbook in cost accounting,[2] is an example of the use of complicated

TABLE 1

Power Department expense		$50,000.00	Machine Repairs Department expense		$30,000.00
10 per cent of	$40,000.00	4,000.00	20 per cent of power		10,000.00
10 per cent of	800.00	80.00			
10 per cent of	16.00	1.60	Total		$40,000.00
10 per cent of	0.32	0.03	20 per cent of	$4,000.00	800.00
			20 per cent of	80.00	16.00
			20 per cent of	1.60	0.32
Total		$54,081.63	Total		$40,816.32

procedures in order to avoid the use of the simple techniques used in solving the income tax bonus problem.

The Expenses of the Power Department for a certain period appears on the books as $50,000 and the Expenses of the Machine Repairs Department is $30,000 for the same period. It is estimated that 20 per cent of Power is used by the Machine Repairs Department and 10 per cent of Machine Repairs is used by the Power Department. What part of the total cost ($80,000 = $50,000 + $30,000) can be fairly charged to each of the two services?

The method advocated by the authors is the "trial and error" method of successive distributions. The required computations are shown in Table 1.

Each total found in Table 1 is the total cost of the corresponding service for the period, but since the problem is to determine the cost of steam service to the rest of the plant, not including the Machine Repairs Department, for example, these totals must be

[2] James L. Dohr, Howell A. Ingraham, and Andrew L. Love, *Cost Accounting*, New York: Ronald Press Co., 1935, pp. 150–51.

multiplied by the proportion of each service which is not used by other service departments. These proportions are 80 per cent and 90 per cent, respectively, so that

Power expense	= 80 per cent of $54,081.63	$43,265.30
Machine repairs expense	= 90 per cent of $40,816.32	36,734.69
Total		$79,999.99

These results are obviously an approximation, and the error of one cent would seem to indicate that one more distribution should have been made in Table 1. When the proportion of interlocking charges is small the error can be reduced by carrying extra decimal places. However, the limit of the approximations can be found.

Analysis of the charges to machine repairs shows that they consist of a series of numbers beginning with $40,000 and that each member of the series is 0.02 of the preceding one. Letting X_2 represent total power charges, the series can be factored as follows:

$$\left.\begin{aligned} X_2 &= \$40{,}000 + 800.00 + 16.00 + 0.32 + \dots . \\ &= \$40{,}000\,[1 + 0.02 + (0.02)^2 + (0.02)^3 + \dots . + (0.02)^n] . \end{aligned}\right\} \quad (13)$$

Although in this problem only four terms were used, complete accuracy would require an indefinitely large number of terms. Thus the total charges to machine repairs can be determined accurately if the limit of the value of the expression in brackets when n increases without bound can be found. This expression is a geometric series, and it will be shown later that its limit is $1/1 - 0.02 = 1/0.98$. The sum of the total charges can now be computed as follows:

$$X_2 = \$40{,}000 \times \frac{1}{0.98} = \$40{,}816 \cdot 3{,}264 \dots . \quad (14)$$

This agrees with the previous result. The solution for the net cost of each service follows the procedure already explained.

The solution above may be expressed in a formula. Referring

to Table 2 for the meaning of the symbols and to the statement of the problem above, the following values are obtained:

$$K_1 = \$50{,}000 \qquad P_{12} = 20 \text{ per cent} \qquad P_{11} = 80 \text{ per cent}$$
$$K_2 = \$30{,}000 \qquad P_{21} = 10 \text{ per cent} \qquad P_{22} = 90 \text{ per cent}$$

where power is Department 1 and machine repairs, Department 2.

TABLE 2

GLOSSARY OF SYMBOLS

(1) Symbol	(2) Meaning for Analysis of Net Worth in Consolidated Balance Sheets	(3) Meaning for Analysis of Interlocking Departmental Costs
K_i	Net worth of corporation i (excluding intercompany holdings from assets)	Expense of Department i for the period
X_i	Total equity of all stockholders of Corporation i (including intercompany holdings)	Total cost of producing Item or Service i, including (unknown) cost of services received from other departments
C_i	Equity of stockholders of Corporation i eliminating intercompany ownerships	Net cost of producing Item or Service i adjusted for services received by and/or rendered to other departments
P_{ij} $(i \neq j)$	Proportion of capital stock of Corporation i which is held by Corporation j	Proportion of Item or Service i which is used by Department j
P_{ii}	Proportion of stock of Corporation i not held by corporations represented on balance sheet	Proportion of Item or Service i used by departments not having interlocking charges

Since \$40,000 is $K_2 + P_{12}K_1$ and 0.02 is $P_{12}P_{21}$,

$$\left.\begin{aligned} X_2 &= (\$30{,}000 + 0.20 \times \$50{,}000)[1 + 0.02 + (0.02)^2 \\ &\qquad + (0.02)^3 + \ldots . (0.02)^n] \\ &= (K_2 + P_{12}K_1)[1 + P_{12}P_{21} + (P_{12}P_{21})^2 + \ldots . + (P_{12}P_{21})^n] \\ &= (K_2 + P_{12}K_1)\,\frac{1 - (P_{12}P_{21})^{n+1}}{1 - P_{12}P_{21}}. \end{aligned}\right\} \quad (15)$$

The fraction above can be shown to be equal to the expression in brackets. When n increases without bound, $(P_{12}P_{21})^{n+1}$ be-

comes smaller, approaching zero as a limit. Since the limit is required in this problem the last expression in (15) becomes

$$\left.\begin{aligned} X_2 &= (K_2 + P_{12}K_1)\,\frac{1-0}{1-P_{12}P_{21}} \\ &= \frac{K_2 + P_{12}K_1}{1-P_{12}P_{21}}. \end{aligned}\right\} \tag{16}$$

Since the first distribution in Table 1 might have been made from Department 2 to Department 1, the solution for X_1 may be derived from (16) by merely interchanging subscripts.

$$\left.\begin{aligned} X_1 = \frac{K_1 + P_{21}K_2}{1-P_{21}P_{12}} &= \frac{\$50{,}000 + 0.10 \times \$30{,}000}{0.98} \\ &= \$54{,}081.6326\ldots\ldots \end{aligned}\right\} \tag{17}$$

The formulas derived by the process of finding the sums of infinite series or determining the limit of the results obtained by the trial and error method of successive distributions can be derived much more simply by solving a set of simultaneous equations. Referring to the glossary of symbols and to the statement of the problem, the following relations are given:

$$\left.\begin{aligned} K_1 + P_{21}X_2 &= X_1, \\ K_2 + P_{12}X_1 &= X_2. \end{aligned}\right\} \tag{18}$$

That is, the total cost of producing one service is the direct cost of that department plus the shares of the cost of other departments represented by the proportion of the services of other departments used by the given department. Equations (18) can be written

$$\left.\begin{aligned} X_1 - P_{21}X_2 &= K_1, \\ -P_{12}X_1 + X_2 &= K_2. \end{aligned}\right\} \tag{19}$$

Multiplying the first equation in (19) by P and adding to the second equation,

$$X_2 - P_{12}P_{21}X_2 = K_2 + P_{12}K_1. \tag{20}$$

Solving for X_2,

$$X_2 = \frac{K_2 + P_{12}K_1}{1 - P_{12}P_{21}}, \tag{21}$$

a result which agrees with (16) above but which is derived more simply.

A more important property of the simultaneous equations solution is that it may be easily generalized to the case of any number of departments with interlocking charges and to many other problems which involve variable quantities which are mutually determined, including problems arising in consolidated balance sheets suggested in Table 2.

Since the analysis of "Net Worth" in consolidated balance sheets presents exactly the same type of mathematical problem as that of interlocking departmental charges, the general solution will be discussed for the case of n corporations for which a consolidated balance sheet is to be compiled. If the stock of each company consists of the same grade of common stock, the proportion of each company's stock owned by every other company can easily be computed and the net worth (excluding intercompany holdings from assets) of each company is known. If the total equity, including investment accounts, of each corporation were known, the (known) net worth (excluding intercompany holdings from assets) could be expressed as the total equity of that company less the sum of the products of the total equity of each of the other companies by the proportion of shares of that company owned by the given company. The set of n simultaneous equations appear as follows:

$$\left.\begin{array}{rl} X_1 - P_{21}X_2 - P_{31}X_3 - \ldots\ldots - P_{n1}X_n = K_1\,, \\ -P_{12}X + \quad X_2 - P_{32}X_3 - \ldots\ldots - P_{n2}X_n = K_2\,, \\ \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \\ -P_{1n}X_1 - P_{2n}X_2 \qquad - \ldots\ldots + \qquad X_n = K_n\,. \end{array}\right\} \tag{22}$$

The foregoing equations can be solved by any method appropriate for solving systems of simultaneous equations, but the general solution is easier to express in determinant form. Let

$$D = \text{Determinant of the system of equations} \tag{22}$$

and

D_i = Determinant obtained by substituting the column of K's for the ith column in D.

The solutions for equation (22) are of the form

$$X_i = \frac{D_i}{D}. \tag{23}$$

The method of summing infinite series in geometric progression can be extended to show that the solutions represented by equation (23) are the limits approached by the trial-and-error method, but the number of infinite series rapidly becomes unmanageable. For example, each solution of a problem involving three corporations or departments consists of the sum of five infinite series, four of which are series of sums of infinite series. Thus the method is probably not practical for more than three variables.

The method of simultaneous equations, on the other hand, is applicable to any problem for which the trial-and-error method of successive distributions is appropriate, although, of course, joint costs and difficulties of measurement in cost accounting and the existence of bonds and various types of stocks in balance sheet problems may make the application of either method difficult. Whenever fairly good estimates of the P_{ij} values can be made, the method of simultaneous equations should be useful.

BOOK REVIEWS

International Monetary Issues. By CHARLES R. WHITTLESEY. New York: McGraw-Hill Book Co., Inc., 1937. Pp. v+252. $2.50.

Monetary literature, large as its volume is, lacks an up-to-date analysis of the comparative merits of gold versus paper standards. A dogmatic attitude prevails; the inclination of most writers seems to be either to ignore the problem or to "prove" the case in the same way as was usual in the discussion about the social order, when the idealized features of the one system were confronted with shortcomings in the actual application of the other.

Professor Whittlesey starts out with the promise to offer us the badly needed comparative analysis. Unfortunately, it disappoints the reader by an obviously biased attitude and by an unorganized presentation. So far as a summarization is possible, the essential thesis of the book seems to be this: Paper money with fluctuating exchange rates had no real test in history. It was called upon when the gold standard failed, and its reputation suffered accordingly. In reality the gold standard—burdened with "disastrous short-term capital movements" (p. 123)—is not better or, rather, it is less good than the other which lends itself to management and to stablization. Gold, on the other hand, due to the rigidity of exchange rates, is an obstacle to a rational control of the currency, lacks resistance against a crisis, and contributes to (or causes) instability. The basis of its popularity (p. 67) is irrational, according to the author. The implication is that all banking and monetary statesmanship of the last centuries was irrational, and that all economists of standing used to think in a nonrational way. Nor is the author disturbed by the fact that paper money is used only in emergencies, after which the world always hastens to return, *de facto* or *de jure*, to gold. History means little to a zealous reformer who uses virtually no historical material except references to the post-war era. But what about his logic?

To begin with, what is meant precisely by a policy of unstable exchange rates? What is the system like, with reference to which a managed currency should be managed? Should the exchange be left to seek its own level, or should it be managed? If so, for what purpose

and on what pattern? So long as nothing substantial is said about the nature and purport of the new standard, all comparison with the gold standard is futile. It appears in places that Professor Whittlesey's ideal currency of the future may not only use gold in any amount to clear international balances but may even permit gold movements to exert "much the same effect" (p. 174) as under the gold standard. What, then, is the difference between the two standards?

Nor does the author make any serious attempt to define or describe what he means by gold standard. On the one hand (p. 20), he argues against it, because it is never really "automatic"; on the other hand, he charges it with a nonnatural automatism (p. 49). The straw figure which he mostly assumes as a gold standard apparently lacks control devices. Such an enemy is easily defeated, and paper money, in turn idealized as the equilibrium-creator, averages two or three victories per page of the book.

What devices does the Whittlesey paper currency offer to check abuses of paper money, the possibility of which the author admits? Here is his answer to this fundamental question:

> No satisfactory answer can be given to this question since the answer depends chiefly upon one's confidence in the willingness of governments and governmental agencies to obey laws. But the gold standard also is a creature of laws, and laws could be framed that would make a paper standard as safe, so long as the laws were obeyed, as the gold standard. It is scarcely admissible to assume either that these other laws will not be obeyed or that the laws upon which the gold standard depends will be obeyed at all times [pp. 191–92].

This repeated reliance on obedience to the law as ultimate regulator is just as typical for the fascist (and communist) type of thinking in the twentieth century as the reliance on the automatism of enlightened self-interest was typical for the liberal and capitalistic approach in the nineteenth century.

Nothing is more characteristic for the antigold bias of the author than his approach to the interrelation between monetary and commercial policy. He appears to be a liberal and denies ardently that "an independent monetary policy necessarily promotes nationalistic commercial policies" (p. 235). However, nothing is said about the fact that lowering the gold content of the currency is one of the most effective methods of protectionism. Instead, he argues that "the one condition that makes arbitrary restrictions on trade superfluous and irrelevant is the adjustment of internal prices to world prices" (p. 236).

Indeed, no "arbitrary" restrictions are needed, if the home producer can be protected by proper "adjustments" with the aid of exchange manipulations. Is it not astonishing that a free trader should argue more or less openly (pp. 6, 195, etc.) against the impact of foreign price changes on the price level at home? How can one advocate bigger international trade and better "independence" of home prices at the same time? "In short," concludes the would-be free trader, "freedom of exchange rates should help to insulate a country against the influence of cyclical disturbances or monetary instability originating abroad . . . ." (p. 233). A 100 per cent ad valorem duty could not do any better; and "insulation" is a fairly good substitute for "autarchy." Small wonder that we also find "a healthy equilibrium . . . . consistent with ordinary tariff barriers" (p. 16).

It takes a dialectician, rather than an economist, to maintain that the gold standard itself is responsible for whatever panic was due to the fear—of leaving the gold standard (pp. 21 f.); that Germany in 1923 would have been worse off with stable than with the rapidly deteriorating exchange rates (p. 33); that gold is not an appropriate standard because "another great war or another great depression would cause grave injury" to it (p. 35—as if a paper standard would not suffer even more "injury"); or that paper can provide both safety of internal prices against international pressure (p. 233), as well as greater "mobility" of home prices in accordance with international values (pp. 16, 20, and 30). One could scarcely show stronger insistence on the principle of having the cake and eating it too. One reason for these and similar inconsistencies is the author's violent dislike of any "deflation"—a bias which is incompatible with his own desire to maintain freedom in international relations.

A major part of the book is devoted to "proof," presented in nontechnical language and without much reference to literature, that the balance of payments "equilibrates" under a paper standard (has that ever been questioned?) and that fluctuating exchange rates are not detrimental to international trade and to capital movements. Many other aspects of the monetary problem are altogether omitted. So far as it goes, the discussion turns around short-run problems, politely leaving the "long pull" to the "classical" theories which are confounded with "static" analyses (pp. 111–12), but occasionally (e.g., pp. 157–63) reverting to long-run aspects. The argument is carried on in the rarefied atmosphere of a nondefined standard and under the (implied) assumption that businessmen will adapt their actions to

changes in exchange rates without giving much thought to future fluctuations. It is highly instructive to see a learned economist devoting a hundred or more pages to the economic repercussions of exchange fluctuations, without virtually a single reference to the possibility of the businessmen anticipating such changes and acting on expectations derived therefrom—whereby the monetary management may be brought into most serious difficulties. Or do we assume that the *homo economicus* either has no sense or recklessly neglects to think of the future and blindly follows the authorities? Most noteworthy about this approach is the fact that it happens to be the same which prevails among the numerous admirers of the corporate state and of planned economy.

MELCHIOR PALYI

Banking and the Business Cycle. By C. A. PHILLIPS, T. F. MCMANUS, and R. W. NELSON. New York: Macmillan Co., 1937. Pp. viii+274. $2.50.

In this study three authors jointly pursue a dual objective. They offer not only an explanation of the basic forces which, in their judgment, produced the great depression and are likewise responsible for its undue prolongation but also a generalized theory of business cycles. The contributions of the writers are so well blended as to create the impression of single authorship; the organization of the material is excellent; the style is unusually clear; and the entire study bears abundant evidence of careful, mature thought. It is characterized by the qualities which we have come to expect of work done by Professor Phillips or by others collaborating with him. Business-cycle and monetary literature is enriched by this study.

The argument throughout is directed to the central thesis that "the boom and depression . . . . were proximately caused by central bank credit expansion" (p. 117), or, in the words of Professor T. E. Gregory, as quoted by the authors, to the "disregard of the rules of common sense in the treatment of the money supply of the United States" (p. 4). The economic convulsions now afflicting us, as well as the questionable prosperity of the years immediately preceding, must therefore be looked upon as predominantly bank-credit phenomena. Our present plight is fundamentally the heritage of inflation, i.e., of "a state of money, credit, and prices . . . . arising from any increase in the effective supply of circulating media that outruns the rate of increase of

the physical volume of production and trade, thus forcing a rise of prices" (p. 13).

The trouble began—so runs the analysis—during the World War period, when extensive commodity-credit inflation took place. As a means of meeting wartime fiscal needs, government resorted to the unsound practice of extensive borrowing, instead of relying more heavily upon the wiser policy of taxation, and, through the sale of bonds to banks, called forth a large amount of fresh bank credit. Since the great increase in purchasing power thus created was not accompanied by a corresponding increase in production and trade, the inevitable result was a general advance in commodity prices. To be sure, the writers accord a measure of validity to the contentions of such authorities as Dr. David Friday and Professor W. C. Mitchell, that the rise in prices in this country was caused by the enlarged European wartime demand for American goods, and they also recognize a contributing cause in the influx of huge quantities of gold from Europe. Nevertheless, they insist that the phenomenal increase in prices cannot be explained wholly in terms of enhanced European demand or an addition to our gold supply. Bank-credit inflation was primarily responsible.

Great stress is placed by the authors upon the influence of the Federal Reserve System in aggravating wartime inflation. Thus it is their contention that

> without the superimposition of this system of central banking, or bankers' banking, upon the American banking system almost coincident with the outbreak of the War, the inflation during the War could not have progressed to the height it did, or at least would not have done so without suspension of the gold standard and resort to irredeemable paper money [p. 22].

As was to have been expected, following the war correctives began to operate upon an abnormal, inflated general price level, and a powerful tendency of prices to fall began to manifest itself. Drastic deflation took place in 1920–21. But the liquidation which was necessary to bring about wholesome readjustment in the structure of prices, production, and finance, and to establish equilibrium relationships, was no allowed to run its course. If liquidation could have been completed at that time, the authors infer, we should have been spared many of the economic ills which have since risen to plague us. But, instead, Federal Reserve banking authorities intervened with a policy of "managed currency" and strove to maintain an artificial price level by means of

additional bank credit. As a consequence, deflation was halted, the processes of necessary readjustment were stayed, and the country entered upon a period of further credit inflation.

It is significant, however, that post-war inflation took place in the investment field in contrast to the commodity-credit inflation of the war years. The authors attach much weight to that development. An enlarged volume of bank credit greatly stimulated new investments, thereby altering significantly the structure of production by increasing capital goods relatively to the output of consumption goods. Further, the amount of purchasing power thus created exceeded that of real savings being made by people, "producing a disequilibrium between saving and investment" (p. 7). The result was "a movement of the economic system away from equilibrium rather than toward it" (p. 7). Again the Federal Reserve System is held to be chiefly responsible for what happened, on account of its "easy money" policy. Although the writers admit that the Federal Reserve Board was quite successful in "managing" the price level, they hold that "there is but little doubt that the depression, in the final analysis, was the price paid for that experimentation" (p. 176). Expansion could not continue indefinitely. There is a limit to the amount of new "excess" credit that can be created, even by a central bank. When that flow is either contracted or decelerated, the boom must end. The end was reached in 1929.

But even then, continue the writers, "every effort was made to avert or delay the necessary liquidation, both by Federal Reserve action aimed at sustaining the market situation and by the widespread advocacy of a policy of maintaining wage rates on the part of government, trade unions, and employers" (p. 9). Events finally culminated in the banking panic of 1933 and the inception of the New Deal economic policies. The secondary post-war business cycle thus came to an end.

Attention may now be directed to the generalized theory of business cycles which the writers offer, and which grows logically out of their analysis of the underlying causes of the boom and the subsequent collapse. In their opinion the cycle is basically a central banking phenomenon. In formulating their view they follow closely, but not uncritically, the theories of Hayek, Keynes, Robertson, Mises, and others of similar thought, and they acknowledge fully their debt to those significant contributors to trade-cycle theory.

But if the explanation of industrial fluctuation which is offered in this study is at bottom monetary, in fully developed form it is con-

siderably more than that. In reality it is an eclectic theory—and therein lies its chief significance—in which are integrated views of the business cycle often considered to be conflicting rather than complementary, viz., the monetary, the structural, and the equilibrium theories. On this point the words of the writers themselves are particularly apt.

> The monetary or bank credit theory occupies first rank in the chain of causation and explains the origin of the boom; the structural view, with its emphasis upon the changes in the structure of production and the disequilibrium between saving and investment, explains the underlying character of the boom; and the equilibrium theory is necessary to describe the depression proper and to explain its severity and persistence. All three theories in combination give a more nearly complete understanding of the whole cycle than can any single or more particularistic view [pp. 3 and 4].

The major interest of the authors ends with the climactic events of 1933, but since "diagnosis without prescription admittedly is of little value," they proceed to point the way to satisfactory recovery. That way is not through "pump priming," creation of new monetary purchasing power, inflation or "freezing" the price level when it should be permitted to fall, and spending, but by the elimination of disequilibria in the economic system and, perforce, the achievement of a new and sound equilibrium, and by saving and investing. Essentially that means bringing costs into profitable relationship with prices, especially in the capital goods industries, so that the disparity between costs and the value of new investment will be corrected. Wage scales, in particular, should be "genuinely flexible." On that sore point the authors' word of cheer to wage-earners is that "the increased volume of employment and the reduced prices that would follow from such a policy would shortly raise the real income of labor far above any level at which it could be maintained in the face of depression conditions" (p. 9).

In the opinion of some readers at least, the authority with which the authors speak will be vastly enchanced by their apparent prescience. They wrote when a marked degree of recovery seemed to be taking place. They recognize it but hasten to add that

> when a recovery program, which, while it may appear effective, depends for its efficacy upon much the same kind of "cheap money" inflation which our analysis has shown was the main cause of the Great Depression, then the present recovery must ultimately prove as illusory as the New Era of the "twenties"; and it is the duty of economists to pierce the veil of illusion [p. 212].

As economists who are also human beings, perhaps the writers now derive as much satisfaction from that sentence as from any in their book.

Other readers will probably feel that, in order to give their subject fuller treatment, the writers should have woven additional strands into their analysis, such as, for example, a discussion of the parts played by our misguided tariff policy, by the war-debt problem, and by the rigidities introduced into the economic system through monopolistic practices. In fairness to the authors it should be pointed out that they were fully aware of the influence of those factors but did not consider them to be predominantly basic and therefore really inside the scope of their survey.

Still other readers who are in substantial agreement with the diagnosis set forth in this book may have some reservations as to the prescriptive observations of the authors in respect of events since 1929. They are the people who wonder, shuddering slightly meanwhile, as to what the political and social consequences might have been had strictly "sound" economic policies prevailed and thoroughgoing liquidation and readjustments promptly accepted in place of some of the more questionable policies, economically speaking, of the New Deal and also of the preceding administration. They are the people who feel that human problems, although largely economic in this age, cannot be effectively dealt with solely as economic problems, desirable as that might be. Sheer expediency may demand that factors other than economic be given some weight in the formulation of a workable policy, at least in a society such as ours. But that is to introduce imponderables with which the economist does not profess to deal, even though his may prove to be about the last word in the long run.

R. S. VAN DE WOESTYNE

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The Interstate Commerce Commission, Part III. By I. L. SHARFMAN. New York: Commonwealth Fund, 1935, 1936. Vol. A: pp. xiv+684; Vol. B: xiv+833.

Part III of Professor Sharfman's elaborate study of the Interstate Commerce Commission is concerned largely with the policies developed by the Commission in the exercise of its regulatory powers. It is published in two volumes.

Volume A contains a detailed analysis of the Commission's work under the Valuation Act of 1913, and of the Commission's administra-

tion of numerous provisions of the Interstate Commerce Act which may be conveniently grouped under the title of control of organization and finance.

The valuation project was a tremendous undertaking, and the Commission's performance of the task, says Professor Sharfman, "seems worthy of the highest commendation." Yet Professor Sharfman does not hesitate to criticize certain features of the valuation work, notably the failure to include estimated original cost figures in the primary valuations; failure "to dispose unmistakably and quantitatively of the claims for intangibles" instead of "merging the estimate of the intangible elements in the larger exercise of judgment by which all the factors were combined"; and, finally, the failure of the Commission to indicate the process by which the various elements of value were combined to reach a final figure. Sharfman is by no means unaware of the reasons given by the Commission in justification of its treatment of these matters, but he believes that the Commission could have made a real contribution to the valuation process by a different treatment. Particularly in the failure to explain how final values were reached did the Commission miss an opportunity to "infuse the process with manifest reasonableness." Instead "fair value" remains as mysterious as before —something which is supposed "to spring from a compromise between logically inconsistent elements whose appropriate weights no one dares explain."

The section of the volume dealing with control of railroad organization and finance covers the policies of the Commission in administering the provisions of the Act relating to railroad abandonment, voluntary extension, compulsory new construction, interlocking directorates, pooling arrangements, acquisition of control, consolidation, and the issuance of securities. Here again the Commission's policies win Professor Sharfman's general approval, but in the final pages of the volume he points out that a more vigorous policy on the part of the Commission after 1920, particularly when dealing with railroad finance, might have placed the carriers in a better position to have withstood the depression. Professor Sharfman advocates a stricter policy for the future.

Volume B is concerned with the Commission's policies in the regulation of rates—the first part of the volume dealing with the rate level, and the second with the rate structure. The discussion of the rate level centers about a consideration of the important rate-level cases, beginning with the rate-advance cases of 1910 and ending with the general

rate level investigation of 1933. It is unfortunate that "emergency freight charges" of 1935 was not included. Sharfman finds no evidence of an unduly restrictive policy on the part of the Commission in the 1910 cases or in the 5 per cent case of 1914. But in the rate-advance cases of 1915 there appeared for the first time "an unwarranted reluctance to accord due weight to legitimate revenue needs," and this criticism applied also to the 15 per cent case of 1917. Thus there was substantial ground for the enactment of the more positive rule of rate-making placed on the statute books in 1920 as Section 15*a* of the Interstate Commerce Act. The influence of Section 15*a* is observable in all the rate-level proceedings that have come before the Commission from 1920 to the present time. Although recognizing the insufficiency of carrier revenues from 1920 onward, Sharfman holds that "to attribute this outcome exclusively, or in controlling measure, to the shortcomings of the Commission's policies and practices, is to conceive of the rule of rate-making as virtually establishing a guaranty of earnings, to be artificially effectuated, regardless of the realities of commercial and industrial conditions, as in a vacuum." Sharfman concludes that the rule of rate-making has operated to the advantage of the carriers, and if the Commission has erred in the rate-level cases since 1920, it was in the direction of giving too great consideration to revenue needs in the 1931 and 1933 cases, thereby perpetuating the maladjustments due to rate rigidity in a time of severe price decline. Sharfman points out that the hope that regulation can afford carriers adequate but not excessive earnings at all times is an illusory one, and that in an unstable world instability in some degree must be the lot of railroads also. He hopes that in the future a policy may be followed which burdens traffic more heavily in good times, and readily lessens the burden in bad times.

In the treatment of the rate structure Sharfman discusses questions of the reasonableness of particular rates under Section 1, and of the propriety of rate relationships under Sections 2, 3, and 4 of the Interstate Commerce Act. Much of this ground the reviewer has worked independently in the last few years and it is gratifying to find substantiation of one's findings in Sharfman's work. On few points raised by Sharfman would there appear to be other than complete agreement.

One criticism of the Commission made by Sharfman in his concluding pages deserves emphasis. In the early years of its history the reports of the Commission in litigated cases recounted at some length controlling principles that governed its decisions. With the passage of years the Commission has, quite naturally, rendered judgments in a

more summary fashion and with little attention to standards of determination. Sharfman points out the need of "frequent and well-rounded expressions of the lines of thought by which conclusions are reached," and urges "enunciation of majority views in basic matters, in the interest of clarifying policy, not only to outsiders, but to the Commission itself."

These volumes, together with the others in the series, stand as the most complete account of the Commission's work and its policies that has appeared.

D. PHILIP LOCKLIN

University of Illinois

Compensating Industrial Effort. By Z. CLARK DICKINSON. New York: Ronald Press, 1937. Pp. xii+479. $4.50.

One of the naïve elements in the early development of scientific management was the assumption that, given a properly engineered shop, a wage incentive formula relating actual to "standard" performance could be so devised as to constitute a complete system of motivation for workers. Underlying scientific management and piece-rate and bonus formulas was the assumption that human nature was essentially mechanistic.

This view is still widely prevalent among business managers, and is reflected with only slight modifications in practically all treatises on so-called "incentive plans" of wage payment. Despite a remarkably rapid rate of expansion in the application of wage-incentive plans, the narrow, particularistic theory of human nature and motivation referred to above has, however, met with increasing opposition on the part of both business managers and academic students. Human nature, work situations, and motivation have come increasingly to be recognized as exceedingly complex phenomena, far too complex to be encompassed by any simple compensation formula relating some simple measure of actual performance to standard performance.

It is the peculiar virtue of Mr. Dickinson's treatise that his conception of compensation (motivation) rests upon an adequate realization of the complicated character of the phenomena of human beings in work situations. His conception of the problem of human motivation in work situations is therefore much broader than is usually considered sufficient for a study of wage incentives.

In accordance with this broad conception of compensation the first

of three main divisions is an analysis of human nature. Special emphasis is given to reviewing the evidence on individual differences and human drives or motives.

A study of the elements of the wage situation, the influences determining the amount of the wage and the method of payment, and administration of wage payment constitutes the second and major division. Contrary to the practice in most treatises on methods of compensation, Mr. Dickinson gives major emphasis to factors determining the basic time wage, and to the methods and difficulties of measuring the contribution in performance of a worker; by comparison, little attention is given to analysis and appraisal of wage-incentive formulas.

The remaining division discusses and appraises sundry contingent and nonfinancial methods of motivation such as profit sharing, worker-suggestion systems, worker participation in management, hours of work, and working conditions.

The author is to be commended for the breadth of his conception of the relation between employer and employee with respect to the problem of compensation (motivation). In respect to outlining the nature of the problem this discussion is a distinct contribution to management literature, and teachers of personnel management will find it useful.

The treatise is disappointing because it is generally so lacking in specific conclusions and evaluations on the numerous matters discussed. The author may not properly be criticized for failure to give the answers to all or even a major part of the problems raised—such comprehensive knowledge is simply not the property of anybody. He may, however, fairly be criticized for his defective organization and style, and for failure in numerous cases to make an adequate effort to master his data.

The contribution of the author lies in opening up a field for study rather than in providing specific answers or formulas to guide action.

R. W. STONE

University of Chicago

Public Works in Prosperity and Depression. By A. D. GAYER. National Bureau of Economic Research, 1935. Pp. xx+460. $3.00.

The author discusses the proposal that properly planned and budgeted public works, in a flexible program, may be employed to retard or stimulate business activity. In the past, public works have expanded

in prosperity and contracted in depression, thereby accentuating prosperity at one time and depression at another. The author presents an analysis of public works in the United States over the period 1919–34 and offers data for the valuation of the possibility of employing public works in a program of economic stabilization. He has compiled and analyzed statistics of federal, state, and local public works in a comprehensive survey.

Professor Gayer believes the attempt to stimulate business and alleviate unemployment in the period 1930–33 by increasing the rate and amount of public works encountered but little success. Although federal outlays rapidly expanded, state and local outlays fell to half their previous level. In this period public works were constructed without careful advance planning. The experiment in this period, in the author's opinion, is of little value in appraising the advantages and disadvantages of planned flexibility in public works. The results of the hastily improvised public works show the weaknesses of a program of rapidly increasing public works without thoughtful long-range planning and with an absence of adequate credit reserves. Yet, in spite of serious limitations, considerable success was enjoyed in augmenting public works in particular directions.

The author concedes that there are difficulties of a practical nature in planning public works to mitigate economic instability and believes that a public works program can operate only within certain limits. Much construction must be undertaken at a particular time, but many projects could be transferred from one time to another. The proper timing of public works, however, is very difficult. Professor Gayer is of the opinion that public works ordinarily represent too small a fraction of total spending for them to be substituted for business spending. They can be employed only for "priming the pump" of private spending. There is a danger that public works expenditures may decrease private spending and thus accentuate depression. Construction costs may also be maintained at a fixed level.

The author argues that the possibility of increasing economic instability of public works can be lessened by proper long-range planning. Such planning will also minimize waste, provide enough construction to increase employment substantially, establish adequate credit reserves, and concentrate construction at the most effective time after the early stages of depression have passed. The book is an important contribution to the literature of public works and business cycles. The merits

and defects of public works programs are indicated and the desirability of planning public works with reference to the problems of business cycles, where this is feasible, is made clear.

ALFRED G. BUEHLER

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Capital Surplus and Corporate Net Worth. By RAYMOND P. MARPLE. New York: Ronald Press, 1936. $3.00.

The aim of the author is stated in the Preface of this book to be the presentation of "a unified body of principles with respect to capital surplus," but the scope of the work is considerably wider than this statement would indicate. Beginning with a concise differentiation between legal and invested capital, Mr. Marple cuts a path through the extant maze of heterogeneous legal requirements and confused accounting thought, and sets forth some logical solutions of various problems of valuation and presentation of corporate proprietorship.

The discussion of treasury stock transactions results in suggested improvements in current methods of reporting such data. A careful analysis of asset revaluations gives recognition to several factors which may cause such value changes; the separation of the effects of these factors results in new balance-sheet treatment of revaluation surplus. The reduction of stated capital by write-downs of capital stock is presented in some detail; abuses in this connection are pointed out. Capital surplus is given a distinct function among the net worth items, as opposed to the current practice of using it as a convenient resting-place for unfavorable or unclassified net worth transactions.

A few ambiguous statements and misprints mar the otherwise clear and direct style of the author. Only slight attention is given in the exposition to no-par stock without stated value. The final chapter terminates rather abruptly; a summary section would have improved the book. However, these deficiencies do not materially detract from the overall merit of the work.

Although the book was written from the viewpoint of the professional practitioner, it can be recommended to teachers and students of accounting, also, as a critique of the illogical practices which have originated from the fact that (as Mr. Marple puts it) "the accountants have allowed the lawyers to do their thinking for them."

WILLIAM J. VATTER

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Profit Sharing for Wage Earners. By C. CANBY BALDERSTON. New York: Industrial Relations Counselors, Inc., 1937. Pp. viii+156. $2.00.

From time to time during the past half-century, but particularly during periods of business recovery, profit sharing has been rediscovered and widely hailed as *the* road to industrial peace. We are now in the midst of—probably passing through—another such era of widespread interest. This fluctuating interest in profit sharing, although highly correlated with variations in organization activities of trade-unions, is related to more deep-seated and continuing factors, such as interest of management in promoting the economic security of workers, development of a more co-operative and efficient work force, and adjustment to the popular issue of "property versus human rights" by making workers participants after payment of a "basic wage" to capital. During recent months, in addition, the device has received political sponsorship. The Borah–O'Mahoney antimonopoly bill accepts profit sharing as a proper method of paying out a compulsory distribution of surplus, and Senator Vandenburg has introduced a Senate resolution to have a study made of profit sharing. In these cases the objectives are to keep corporations from growing "too big," and to enhance wage-earner purchasing power.

The study by Mr. Balderston is a timely addition to our knowledge of a managerial device of infrequent and most often disappointing use but of tenacious vitality. The study reviews experience with profit sharing in Great Britain as well as in the United States. An extensive canvass of firms in the United States disclosed a total of 144 companies in which profit-sharing plans had been organized. Active plans were found in only 63 of these companies—a number entirely out of proportion to the extensive literature of the subject and the recurrence of popular interest.

The tabular analyses and critical evaluation of the detailed features of these plans should make this study indispensable to any business contemplating a program of this sort.

In general, the author concludes that, for firms having a high and relatively stable ratio of profit to pay roll, profit sharing may be a desirable method of providing for the economic security of workers. To accomplish this purpose the share should be held in an invested reserve against risk of loss of wage income, i.e., shares should not be paid currently in cash. In the opinion of the reviewer this position

is too rigid. Profit shares distributed quarterly or monthly in cash may frequently serve the useful purpose of providing a wage adjustment to living costs and competitive standards during the upswing of a business cycle, and thus avoid difficulties inherent in establishing higher basic rates.

The author is certainly correct in judging that profit sharing is no substitute for a well-rounded program of personnel management.

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